THE

ELECTRICAL REVIEW.

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THE

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ELECTRO-PEAT FUEL.

OUR readers may perhaps recollect that the Electro-Peat Fuel Co. and its various doings were referred to by us on November 13th, 1903, April 22nd, 1904, and August 12th, 1904.

When the company gave its so-called demonstration at the works of Messrs. Johnson & Phillips, we were present and formed our opinion on the electrical part of the business. We endeavoured to extract some definite information from the gentleman who, as everyone present was told, was there for that purpose. We failed to extract such information, and so little did this expert appear to relish our questioning that he fled to a friend, whom he greeted with effusion, and we saw him no more.

We believe our opinion of the affair was shared by all engineers and electricians who gave the matter serious attention, and that the promoters can never say that they had hopes held out to them by disinterested experts that their process possessed real value. True, there were both chemical and engineering reports published by the promoters, and we drew attention to these because they appeared to us to contain an ambiguity of expression in regard to calorific values, kilograms and pounds and British thermal units, exceedingly likely to deceive the non-expert.

Indeed, it would be easy for the ordinary layman, with a little knowledge, to believe that the peat briquettes were more valuable calorifically than Nixon's navigation coal.

In the *Irish Independent* of September 12th, we find what professes to be an account of the Peat Co.'s works at Athy, Kildare, and we note the name of Mr. J. R. Bessey, who was prominent in the promotion syndicate, as the inventor of the electric process.

Electricity is still put forward as the saving grace of the system. We say nothing against the mechanical process of kneading the peat, save that as seen by us at Charlton, its output appeared too small for the business to be a financial success. We say nothing against the system of centrifugal drying, if it can be carried out at much higher velocities in a continuous manner. Irish peat cannot be successfully turned into a commercial industrial fuel, except it be garnered in a thoroughly mechanical manner, and so treated also, and the process, whatever it may be, that is ultimately successful, must be stripped of all extraneous chimerical notions, to which in our opinion this electrical fad belongs.

We should like to see Irish peat brought to market successfully, and because we think this electrical business is likely again to throw discredit on peat do we the more regret the present company's operations.

It is a curious but undeniable fact that funds are always readily forthcoming to support an unsound scheme, whilst it is only with the greatest difficulty that capital can be raised to carry on sound industrial concerns. Not only is this so, but the shares in such questionable schemes are not infrequently run up to a premium (as, we have reason to believe, has been done in this case), giving the promoters the desired opportunity to unload.

The credulous public cares naught for the opinion of independent experts; the report, more or less ambiguous and vague, of some employé of the promoters appears to be swallowed without an effort. Truly, the ways of the average investor are inscrutable and peculiar—he and his money are soon parted!

D

Steam Heating in connection with Electricity Supply.

If one paragraph of Mr. J. A. Bendure's paper on the "Waste Products of a Central Station," read before the Ohio Electric Light Association in August last, be correct, the title becomes a flagrant misnomer, and electrical energy sinks to the importance of a by-product. We are gravely informed that "the income per mile of steam mains is in excess of either gas, or electric light, or water, and a very large majority of buildings pay from three to four times as much for heat, as for light, water and power combined." The author makes use of a singular standard of comparison, giving the amount of steam (pressure and percentage of moisture unspecified) required per thousand cubic feet of space (time unspecified) as varying between 10,639 lb. and 12,843 lb. for residences, from 6,923 to 8,045 lb. for business blocks, 5,319 to 6,416 lb. for schools, and 3,305 to 4,051 lb. for schools. The variations are, presumably, dependent upon the severity of the winters. Prices charged in two different instances are given as varying from 45 cents to 60 cents per 1,000 lb. net water consumed. Unless losses in the mains are enormous, a payment of from 18s. 9d. to 25s. for the approximate equivalent of 1,000 gallons of water evaporated, from and at 212° F., certainly seems remunerative; indeed, we would like to go into such a business ourselves in a really compact area of supply. This inclination is checked by the fact that we know nothing of the thermo-dynamics of the case as they work out in practice; thermally, the radiation losses not used in raising the temperature of the building to be heated, should, in all probability, exceed those of an isolated plant. Why cannot American central station engineers talk about the matter thermo-dynamically, and speak of thermal units needed per 1,000 cb. ft. per hour?

Booth's Circus.

By this time our readers will understand that these words do not signify that we are about to embrace the science and art of trick riding, chariot racing, and animal training, in our editorial arms.

Mr. W. H. Booth, whose life work has been the conversion of engineers to sound principles of steam raising and steam using, has found a certain fame in the pursuit of his professional ideals, but with a couple of letters to the *Times* on a quite remote subject, he has achieved the popular fame which he never sought, but probably does not despise.

The "London Traffic" Commissioners reported that one of the solutions of the problem set them was the cutting of grand avenues from North to South, and from East to West, at a roughly estimated cost of 30 millions, which would have to be expended over a considerable period of years.

Now, these avenues are made necessary in the opinion of the Commissioners, very much by reason of the congestion of the existing streets, which is caused by traffic at crossings blocking traffic proceeding at angles to itself, and Mr. Booth suggested that the benefits anticipated from the wide avenues might be obtained at a mere fraction of the cost by widenings judiciously planned at heavily burdened intersections to permit all traffic derived from any point of the compass, and bound to any other, to proceed in one direction only after debouching into the widening, which would then be called a crossing only by force of custom, and would be called more properly a circus. It matters not in which sense the stream circulates, so long as there is no back-wash or counter current permitted.

The idea is magnificently simple, and very obvious when once someone suggests it. That the spark of light came from one of ourselves should be gratifying to the engineering profession, and in that the idea is applicable with equal benefit to tramways, it should be acknowledged with particular pleasure by the tramway world.

The adoption of the circus principle at important junctions might rob the borough engineers, who are generally responsible for the track, of the proud moment when they can look upon an illustration of some network of record complexity which they have contrived to work into their systems. We have come to look upon these fearful but wonderful examples of the art of draughtsman, permanent way engineer and foundryman, as intended chiefly for spectacular effect, although upon reflection we generally persuade ourselves that some of the myriad curves are really used frequently enough to warrant their creation.

Without question, these elaborate lay-outs cost an enormous sum to buy and construct, cause the cars to make a terrible noise, and require renewal several times as often as the track.

If, then, Booth's circus could be used instead, not only would traffic be facilitated in proportion as the crossings were congested before, but a heavy item of expense to the tramway undertaking would be minimised, and the cars themselves would suffer less, while the nerves of frontagers might be less assailed.

The Ionisation of the Atmosphere.

There are several agencies capable of producing the free ions which are always found in the atmosphere. Many of these agencies are meteorological, but there appears to be a fairly constant source of atmospheric ionisation due to the occurrence of radio-active substances in the earth. An interesting research, carried out by A. S. Eve at McGill University and described in the *Philosophical Magazine*, shows that the amount of ionisation due to this cause is by no means negligible. A carefully insulated wire was suspended in an empty water tank three hours at a time, and maintained at a negative potential of 10 kilovolts by an influence machine. At the end of the time the wire was removed and found to be radio-active. By comparing this radio-activity with that produced in a zinc cylinder containing air exposed to radium emanation, it was deduced that the air within the empty water tank was as active as though it had contained half a gramme of radium bromide per cubic kilometre. If the atmosphere covering the land surface of the earth is as active from an ionic point of view as the air of Montreal for an elevation of a kilometre, 600 tons of radium evenly distributed over the earth's surface would be necessary to produce the observed effect. Moreover, if the temperature gradient of the interior of the earth be due to uniformly distributed radium salts, it follows that the layer of surface soil containing the above small percentage of radium would be only a few metres thick. It is calculated from the above data, which are necessarily very hypothetical, that approximately 10 ions per second per cubic centimetre are produced by the radium in the earth's surface. This agency, undreamt of till quite recently, evidently exercises a very powerful influence upon many terrestrial phenomena. It renders the insulation of aerial telegraph wires imperfect, however perfect we make the insulating supports. The effect of atmospheric ionisation on animal and vegetable life has not yet been investigated, but there is strong reason for considering that it is of great importance, and if so, the radium in the earth may have been an important factor in evolution.

Boiler Explosion.

A recent explosion of a Galloway boiler was found to be due to the fact that some of the tubes having leaked, or otherwise proved defective, were removed by men who were not competent to understand that in this type of boiler the tubes are necessary to prevent collapse. Four tubes in all were thus cut out, and the holes blanked.

According to the pressure outside such a flue, it may, or it may not, be safe to remove a single tube; but here were four tubes removed, apparently adjacent to one another, and had

not an explosion fortunately occurred after the removal of the fourth tube, it is possible that other tubes would in time have failed and have been removed, until an explosion of far greater severity had been rendered possible. As it was, the explosion was little more than a collapse, and the rent was sufficient to empty the boiler with a scarcely dangerous rapidity. This case shows the importance of not taking liberties with steam boilers in regard to the removal of tubes or stays. These may not always be essential to safety, and an expert may safely remove them, but he must be a real expert, and not simply a works mechanic.

Rural Railways.

The *Birmingham Daily Post* of Monday contained an article on the agricultural retrospect, which is of interest to others besides farmers. Writing from memory we are not far wrong in saying that the bean crop, although a good one from the point of view of quantity and quality, was nothing less than disastrous to the grower, who was forced to sell to the dealer at something less—3d. or 4d. per "pot" of 40 pounds—than the cost of picking, while the dealer and retailer between them arranged matters so that the consumer never bought beans at less than 1½d. per pound.

This kind of thing is not new, for it happens every time there is a good crop, and is chronic to a certain extent. The farmer, who is more or less removed from market centres, suffers, and the consumer everywhere is pinched to pay the middleman.

We allude to this bean business not because it is peculiar, but because, on the contrary, the trouble which has made this particular crop unfruitful to the growers is common to all crops which have to be hauled any distance to the point of sale; and we take the opportunity to urge once more the construction of real light railways into and through the rural districts. If the country waits until the company promoter steps into the breach it may have to wait long, and it may rue it when he comes, for such enterprises cannot bear the heavy hand of the promoter trained in the field of urban traction. On the slightest capital direct profits will be minute, if they exist at all, and something very different from the ordinary procedure must be used. Probably, as in other parts of the world, in England to a limited degree, and in Ireland to a greater, the State must assist, but the prime movement must spring from the prime sufferers under the existing state of affairs.

If the farmers want to use their land and their toil to better advantage, they must combine to organise and to provide, as far as they are able, means of transport for their crops, and in some way the mulcted consumers must help them.

The construction of these rural lines necessarily must be of the simplest; far different from anything of which the opulent consulting engineer dreams or the Board of Trade permits, and special facilities for wayleaves must be obtained in order to keep the cost at the minimum. The lengths will be considerable, so the voltage will be high; nothing but bare wires on wooden poles can be admitted without ruining the scheme at the outset; the tracks will be stable but light in every way, and the contours will be those of the country, as grading would be prohibitive.

It is unnecessary to go out of the way just now to rake up the old difficulties of collection and distribution. The main point must be conceded, that if the country is to be kept reproductive, the farmers must not be starved, and to prevent this happening it is essential that their land shall be brought nearer to the towns.

SOME RECENT DEVELOPMENTS IN SUBMARINE SIGNALLING.

By ALFRED GRADENWITZ.

Sending sound signals through the air has long been the only means of ensuring the safety of ships in fogs, but the limited range of such signals, and the extreme variability in the sound transmission through the atmospheric air, due to fluctuations in the density and temperature of the medium, as well as to the disturbing effects of wind and the sound-damping influence of snow, considerably reduce the efficiency of this method. There is further the liability of the signal to be disturbed by echoes, and the impossibility of accurately locating the origin of a sound reaching the ear. The majority of the terrible disasters to ships which occur every year, may be said to be due to the vessels losing their course in the fog.

Now, as water is not subject to the same variable influences as air, while it is a more efficient sound conductor than the latter, submarine signals must obviously be far more reliable than those sent through the air. Sea water has practically the same density at any depth, and the velocity of sound in this medium is four times as great as in air; whereas in the latter sound travels about 1,100 ft. a second, the rate in water is 4,712 ft., or almost 1 mile a

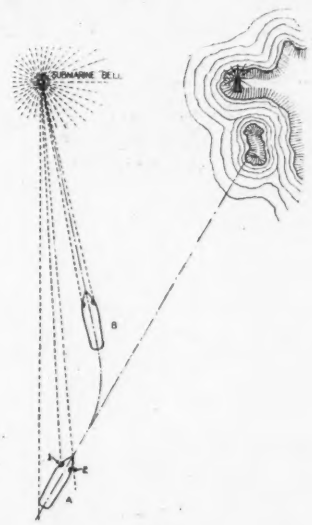

Fig. 1.

second. On the other hand, the velocity of the tidal currents in the ocean is considerably less than the speed of the wind above its surface, which, in the case of storms, will frequently reach 30 miles per hour.

Furthermore, there is below the surface of the sea practically no noise liable to interfere with the sound signals, experience having shown these to be heard and located equally well in the most violent storm as in perfectly calm weather.

A highly important invention, enabling submarine signals to be used with a view to increasing the safety of ships, was made six years ago by Arthur J. Mundy, of Boston. The idea of the "submarine telephone," as his apparatus may be termed, was impressed upon him by the loud report of a stone falling into the water, while his head was beneath the surface. Not being a practical inventor, he induced the late Prof. Elisha Gray to co-operate with him in developing the idea into a practical system. On account of his discoveries in telephony, Prof. Gray was exceptionally competent for carrying out this difficult work. He made the sounds convert themselves into electric impulses by relays, and when this problem was solved, the working out of practical details proved comparatively easy. Shortly before his death, Prof. Gray was able to make a public test before a company of scientists and prominent business men, whose report was highly in favour of his system. Among these men were

Prof. Elihu Thomson and Henry M. Whitney. With the assistance of some eminent engineers and scientists, Mr. Mundy succeeded, after Prof. Gray's death, in carrying the invention through to its present perfect condition.

The apparatus, which is doubtless destined to prove a most valuable aid to mariners in their struggle against fog, is simple in construction, and can be fitted into

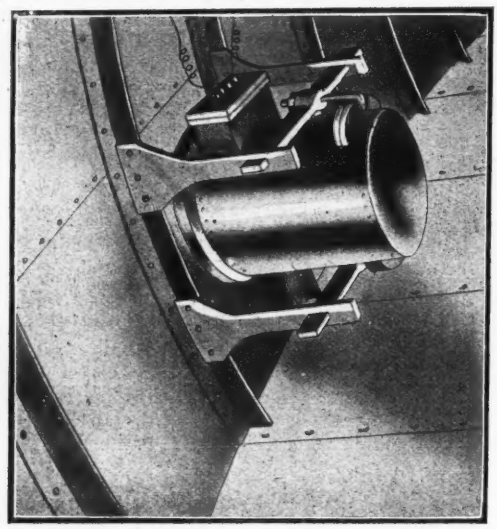

Fig. 2.—Receiver Case in Hold of Ship.

vessels without any great expense, and without any damage to the shell. It comprises two essential parts—viz., a special type of immersed bell, serving to produce the sound beneath the water, and the receivers, by means of which the sound arriving from a distance can be perceived and its direction ascertained.

The two receiving apparatus (fig. 2) are fitted into the hull below water-line to the starboard and port respectively. Each of the two is a galvanised iron tank, the upper cover of which is domed, while a metallic diaphragm in the interior is set vibrating by the incoming sound waves so as alternately to close and interrupt an electric circuit. The motion of the diaphragm is transmitted by means of the circuit to the receiver in the pilot house (fig. 3) in exactly the same way as in the telephone, the whole outfit being nothing else than an application of the telephone principle.

The working of the receiving apparatus will be readily understood from fig. 1, their use being as simple as their construction.

The vessel at A being on a dangerous course, will perceive the sound from the remote submarine bell more loudly through the receiver 1 on the port bow, *i.e.*, on the side turned towards the bell. As the vessel alters her course in the way indicated in the figure, when she is in the position B, the two receivers will both give a sound of the same intensity, and she will have gained the direction of the submarine signal, thus avoiding the imminent danger of running ashore. If, on the other hand, the pilot at the beginning had heard more distinctly the sound through the receiver 2, he would have been advised of his vessel keeping the proper course.

Boston Harbour now has a submarine signal bell not only on Boston lightship, but also a similar bell anchored on Harding's ledge, off Point Allerton. Another submarine bell will soon be placed in the middle of the ship channel opposite Boston light, being sunk deep enough to allow all vessels to go directly over it. Sailing masters can then lay a course straight for this bell in thick weather, whereas at present they have to calculate their position by the bell on Boston lightship.

The system of signalling now in use along this coast consists in ringing signal bells on all the lightships. These bells toll out the numbers of the different lightships, 54 for Boston, 73 for Pollock Rip shoals, 66 for Nantucket shoals, &c. There is an interval of two seconds after each beat of the bell, four seconds between numbers, and six seconds before the code is repeated. These bells are rung by steam pressure and work automatically. In clear weather there is no need for sounding the warning bells, which are rung only when the weather thickens and the foghorns are started.

Vessels coming up from New York by the Vineyard in foggy or squally weather listen first for the bell on Vineyard Sound lightship, tolling out 41. Getting their bearings here, they have a good chance of laying a proper course for Pollock Rip shoals, where another guiding bell may be heard.

The sailing master nearing a port or a dangerous reef where a lightship is anchored, takes down a receiver and moves a lever first to one side and then to the other. The side through which the sound comes indicates that the bell is on that side of the ship. Sound will not travel round a corner under water; it moves in straight lines. Or if, like light, it be reflected, it is so weak as to be readily distinguishable from the sound coming from the same object in a direct line.

Fig. 1, as above, explains how a sailing master can guide a ship by the sound of a submarine bell.

It has been found that the exact position of the bell can be determined in this way to within half a point. As the mariner's compass is divided into 32 points, eight points marking the angle from east to south, for instance, it will be understood how close to the true direction half a point means.

Another device, for enabling the lookout to stand in front of the pilot house and still listen for the bell, is a flexible speaking-tube running from the telephone on the side of the house. The magnets within the telephone make it necessary to keep it some distance away from the compass.

When this mechanism is understood, it is easy to see how readily it can be used for many other purposes than listening for a lightship bell. The screw of an approaching steamer can be heard two or three miles off, for the sensitive microphone in the ship's hold picks up and repeats every sound in the water.

Take advantage of these facts, the Navy Department at Washington proposes to use the submarine telephone first of

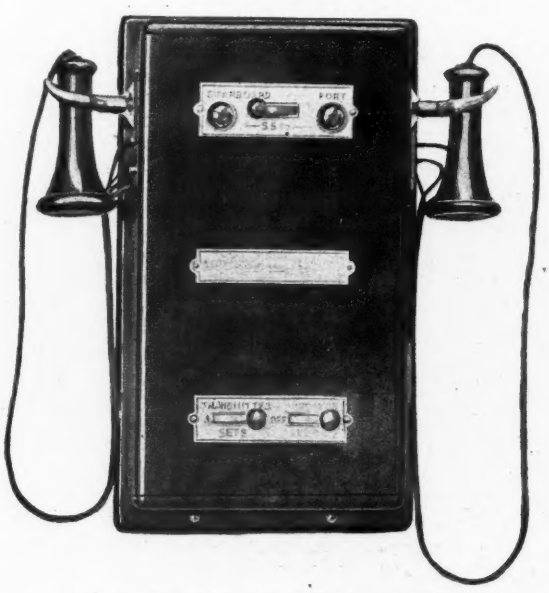

Fig. 3.—Receiving Box in Pilot House.

all for communicating with submarine boats. It has requested the Submarine Signal Co. to build a special apparatus for sending messages. This is now being done in the Signal Co.'s laboratory and workshops, and the instrument is called a multiple sounder. One instrument which is being experimented with has an alphabetical keyboard much like a typewriter. Pressing a key causes a set of hammers to beat on a diaphragm the Morse telegraphic sign for each letter. Anyone who can operate a typewriter can in this way send a submarine message.

A special apparatus somewhat like a stock ticker would

enable the message to be picked up on a submarine boat and turned out on a printed tape. In the same way the message could be sent from the submarine boat and received on a shore station, or on the flagship of a fleet. A still simpler way of sending messages, without any special apparatus of this sort, is by attaching a striking gong or bell to the side of a ship and tapping out a certain code. This tapper can be worked by hand, by steam, or by a pneumatic device. Anyone knowing the code can pick up such messages at a distance of from 5 to 12 miles, through a receiving telephone. It is proposed to have a general code for use by all mariners in communicating with lightships, lighthouses, or with all other vessels having submarine telephones. The Navy Department will naturally have a secret code, perhaps the same as is now used in telegraphing.

The first experiment in sending messages in this way took place last summer at Newport. The yacht *Chipeta*, equipped with sending apparatus, tapped out messages which were received and answered by the submarine boats *Porpoise* and *Shark* while under water. The submarines had no apparatus for replying. The crude method of striking a hammer against the steel sides of the boat was used, but it proved effective. A sending apparatus has been put upon a Government tug at Newport, and experiments are now being made by the commandant of the torpedo station there, with a view to introducing this system as a regular part of the submarine boat service. The Dutch Government has made application to the Boston inventors for this same message-sending device to be used on its submarine boats.

United States naval authorities are now looking to the submarine telephone for communicating between the ships of a fleet while in action. It is feared that wireless telegraphy cannot be relied upon then, on account of the concussion of the big guns throwing the delicate wireless coherers out of order. The flag signals are sometimes unseen, owing to smoke or fog arising and dispersing a fleet. So it appears that the submarine telephone will become an exceedingly important part of a navy's signal system.

Boston ships were the first to take up the submarine signal invention, even before it was a proved success. The Metropolitan line, plying between Boston and New York, was one of the pioneers. For a year or more the boats of this line have been making their courses into Boston harbour, and round Cape Cod, guided by the signal bells along this dangerous piece of coast. Other ships, not equipped with telephones, sometimes lie in wait in Vineyard Haven, and, upon seeing a Metropolitan liner, weigh anchor, and steam after her in order to make a safe passage.

The Philadelphia boats have already been equipped with the system; the Merchants' and Miners' line boats use it. The North German Lloyd is equipping its entire line, and the Hamburg-American line is also installing it. The Canadian Pacific ships and the Allan liners have likewise installed submarine telephones, while Mr. J. P. Morgan's steam yacht *Corsair* was the first large steam yacht to adopt it.

Besides being a safeguard for large and costly ships, it is also available for fishing smacks. Two Gloucester fishing boats, the *Arkona* and *Mary L. E. Hardy*, now each carry a small and simple submarine signalling outfit. This consists of a pair of ordinary telephone receivers attached by wire ropes to two metal bells containing microphones which are let down on either side of the vessel or dory. There is also a light bell which can be let down in the water from a dory and signals tapped upon it.

BREAKDOWNS OF MACHINERY IN 1904.

The report of Mr. Michael Longridge, chief engineer of the British Engine, Boiler and Electrical Insurance Co., of Manchester, has just been issued, and as usual is full of interesting matter, well worthy of perusal. Besides dealing with breakdowns and other mishaps in connection with engines, boilers, dynamos and motors, the report includes the details of elaborate tests on a compound engine using superheated steam, and a Diesel oil engine, each of 500 H.P.

The steam engine was of the vertical compound marine type, built by Messrs. Cole, Marchent & Morley, with unjacketed cylinders 21 and 36 in. × 36 in. stroke, each cylinder having four piston valves for admission and exhaust. The admission valves were opened by eccentrics, and closed by springs through a Dobson trip gear, while the exhaust valves were both opened and closed by eccentrics. The steam was derived from a Lancashire boiler, and superheated in an independently fired Schmidt superheater. Part of the superheated steam passed to the engine through an intermediate reheater. The exhaust steam was dealt with by a surface condenser.

The engine ran at 100 r.p.m., giving 500 I.H.P., with steam nominally at 120 lb. per sq. in. at the stop valve. The following results, amongst others, were obtained :—

I.H.P.	481·3	333·5	145·5
Gauge pressure, lb.	117·5	117	114·5
Temperature of steam at stop valve °F.	743	751	726
Superheat, °F.	395	403	378
Vacuum, in. of mercury... ...	26·4	27·4	26·5
Heat supplied per minute per I.H.P. in B.TH.U.	198·25	192·1	194
Thermal efficiency, per cent. ...	21·69	22·07	21·86
Steam used per I.H.P.-hour, lb.	9·098	8·585	8·742
Equivalent consumption of saturated steam reckoned from temperature of hot well, lb. ...	10·63	10·03	10·12

The engine had been at work for nearly a year, and was found to be in perfect condition. No trouble whatever had been experienced, either in the engine or in the superheater, from the high temperature.

The Diesel engine was of the three-crank vertical type, with single-acting cylinders 22·05 in. × 29·53 in. stroke, and ran at 150 r.p.m., driving a dynamo. The air was compressed in a pair of three-stage air compressors driven by a motor receiving current from the dynamo.

The following are some of the results obtained :—

I.H.P.	634·8	363·6	163·3
Oil per I.H.P.-hour, lb.	0·3264	0·2828	0·280
Average mean effective pressure	96·7	56·33	25·4
Maximum pressure average, lb.	513·3	491·7	488·3
H.P. given out by motor ...	48·3	36·8	26·2
Estimate of mechanical efficiency of engine if pump were driven by it	0·723	0·588	0·198
Estimated oil per B.H.P.-hr., lb.	0·451	0·481	1·415
Calorific value of oil, B.TH.U. per lb.	20,050	20,050	20,050
The heat account, based on the I.H.P., was as follows:—			
Heat equivalent of work done, per lb. of oil, per cent. ...	38·9	44·9	45·3
Heat carried off in jacket water	20·5	26·4	32·8
Heat carried off in exhaust gases	30·2	35·9	21·9
Radiation and error	10·4	−7·2	

Numerous diagrams and curves follow the lengthy tables from which the foregoing data have been extracted, as well as comments on the details of the tests.

Turning to the record of breakdowns, &c., the usual interesting accounts of selected cases are given, with the characteristically luminous and instructive comments of the engineer. Space will not allow of our quoting many of these, but an important note on the explosion of a suction gas plant must be mentioned. During a temporary stoppage of the engine, *two* air-cocks were opened to allow the gas to escape, and after a time the receiver exploded. It is explained that air entered by one of the cocks and mixed with the gas, forming an explosive mixture, which was ignited at the generator, burnt quietly in the scrubber, and exploded in the receiver. Only the cock near the generator should be opened in such a case, and two cocks should never be left open for long together.

By far the greater proportion of breakdowns of dynamos and motors occur in connection with the armatures, rotors, commutators and brushgear—*i.e.*, the parts in motion, actual or relative. Age and deterioration are the chief causes assigned for breakdowns, accounting for about one-third of them, but we regret to notice that bad workmanship and design are responsible for nearly one-fifth. Dirt and neglect readily account for the bulk of the remaining accidents, apart from those due to causes unknown.

The trifling causes which may lead to the stoppage of machines, without really causing serious breakdowns, are abundantly exemplified in the report. For instance, a mouse of remarkably regular habits took up its habitat, inside a motor; the tenant "had evidently been in the habit of

coming home after working hours"—like any honest workman—"and going out before the motor started. By coming home early on the day in question it met its death" by cremation at 230 volts, blowing the fuses and necessitating a visit by one of the company's inspectors. As the motor was used in the daytime, it would appear that this model mouse had employment somewhere during the daylight hours, a proceeding not usually attributed to mice.

A four-pole motor rated to take 45·5 amperes at 460 volts developed excessive heating and sparking, throwing out the overload release, and eventually blowing a 100-ampere fuse. It was found that the negative supply cable made bad contact with the main terminal, and when the nut was tightened the trouble ceased. One end of the shunt winding was connected to the faulty terminal, and the report says:—"Although at first sight it is not obvious why a resistance introduced into the main circuit of a motor should increase the current taken and not affect the speed, yet a little consideration will show that it must be so. For, whilst the voltage across the armature is reduced, tending to reduce the speed, the shunt current is also reduced in the same proportion, weakening the field and tending to increase the speed. The two effects nullifying each other, the speed remains unaltered, but that the motor may continue to drive its load, the current must be increased to make up for the reduction of the voltage through the resistance of the faulty contact. Judging from the melting current of the fuse, about 100 amperes, the voltage must have been reduced by about 50 per cent." At first sight this explanation seems untenable, but it is probably correct. With a heavy voltage drop, and a current of 100 amperes, one would expect very serious burning of the faulty terminal, but no mention is made of such damage; possibly the cut-outs acted too quickly to permit of it. Hints that we glean from the report are the following:—Motor-driven fans should be fitted with carbon brushes, as the fans may be driven backwards when idle, by storms. Commutator connections should form a solid face, or be covered so as to prevent dust lodging between them. Even completely enclosed motors should be cleaned periodically. Motor casings should always be provided with oil drains.

Sharp corners and abrupt changes of section, especially in shafts and spindles, should be as carefully avoided by dynamo makers, as they have been for half a century by steam engine builders. Enormous stresses may be set up by unequal expansion between commutator segments and the quill or sleeve upon which they are often built up. The armature and commutator should be built up on the same sleeve, to avoid relative motion.

The rails on which electric cranes run should be *efficiently* earthed.

Fig. 1 shows the arrangement recommended by the company for connecting a compound-wound dynamo for lighting and charging a battery. The series coils cannot be placed in circuit with the battery, because the change-over dynamo switch cannot connect *a* with *b* and *c* simultaneously; also the lighting circuits cannot receive current direct from the dynamo when the latter is running at the higher voltage required for charging the battery.

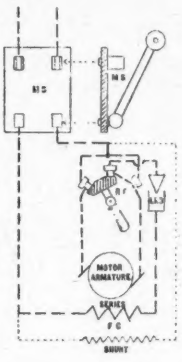

Fig. 2.

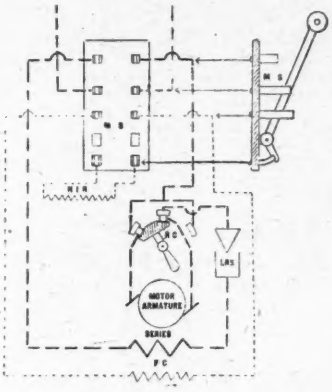

Fig. 3.

Fig. 2 shows a faulty connection for a motor with a liquid resistance (a question raised in our "Correspondence" columns some months ago). The shunt circuit was broken whenever the main switch was opened, and eventually the insulation broke down.

The arrangement recommended by the company is shown in fig. 3, where a non-inductive resistance is thrown into parallel with the shunt just before the main circuit is broken. It will be noticed that the case is complicated by the use of a reversible controller.

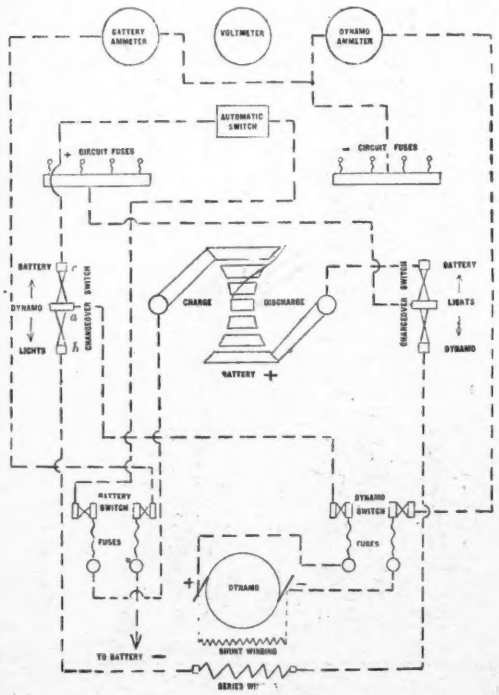

Fig. 1.

THE INTERNATIONAL EXHIBITION AT LIÉGE.

(*Concluded from page* 449.)

For starting the Union gas engine, compressed air of 15 atmospheres (225 lb.) pressure is used. A special air tank is provided which contains sufficient air for several starts and is fed by an electrically-driven air compressor.

The water-cooling and lubrication have also received careful attention, thus ensuring satisfactory working under all conditions.

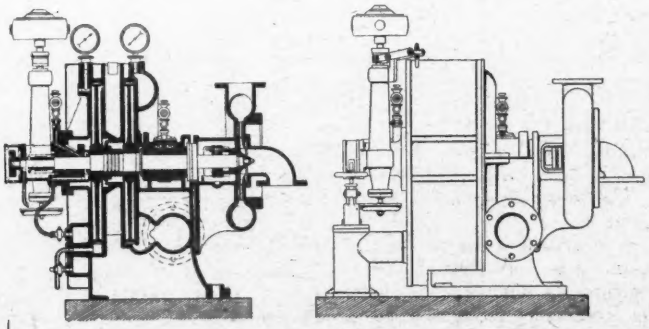

Fig. 5.

The same firm are also makers of steam turbines built to their own designs, and are exhibiting two of these machines.

The smaller is a 40-H.P. horizontal turbine direct coupled to a centrifugal pump, and is shown in fig. 5. This two-stage

turbine represents a type of free-jet single or few-stage turbine built up to 300 H.P.

The larger machines are vertical, and form a combination of a free-jet turbine on the high pressure side, and a few-stage reaction turbine on the low pressure side, thus combining the advantages of both systems; for the free-jet turbine on the high pressure side facilitates the use of partial peripheral admission, thereby allowing the diameter of the diaphragms to be sufficiently large to obtain high peripheral speeds from the commencement, and thus reducing the number of stages. As the volume of steam increases, the admission is increased, until full admission is reached. From this point reaction wheels are used, and the axial depth of the disks now increases with the volume of the steam.

This latter type is represented at Liége by a 300-H.P. turbo-dynamo running at 3,000 r.p.m., and shown in section in fig. 6.

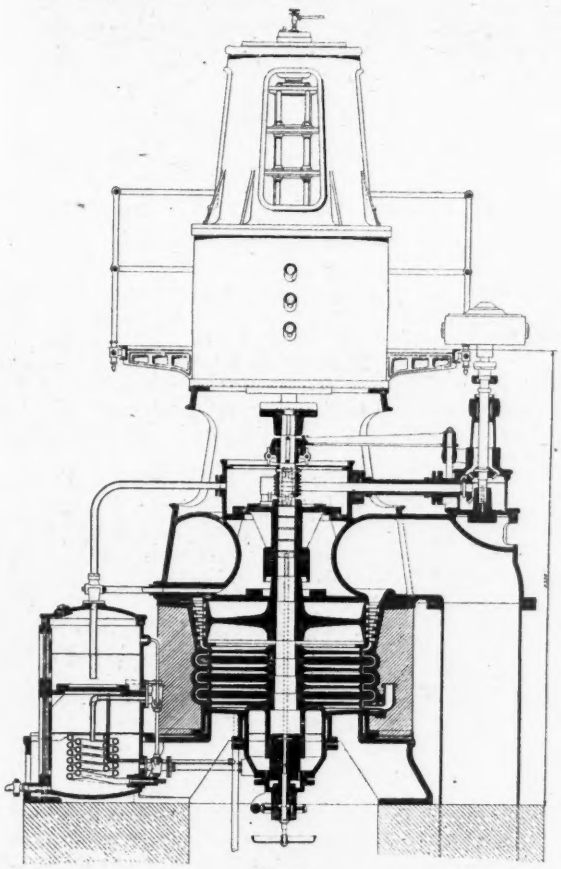

FIG. 6.

At normal load the axial thrust is balanced by the weight of the revolving parts, whereas at reduced or overloads the excessive thrust is taken up by the top or bottom footstep bearing as the case may be.

The disks of these turbines are made of nickel-steel, and are tested singly at a speed of 5,000 r.p.m. In the case of the impulse wheels the Pelton-like buckets are milled into the rim by a patented process, and the blades of the reaction wheels are fixed with the greatest care. It should be noted that the clearance is in no part small enough for the expansion of the metal due to heat to cause any inconvenience.

The following are a few details of the regulating arrangements:—

A distribution valve—fig. 7—built into the main steam pipe, is actuated by the spring governor and regulates the number of nozzles to be fed. No throttling of the steam takes place, and the efficiency remains fairly constant over a large range of load. A special safety valve is provided in case the governor fails to act in any way, which cuts off steam immediately the admissible speed is exceeded.

The engineering industry of France is well represented in most of its branches. The Rateau turbine has been extensively adopted in that country, and the makers, Messrs. Sautter, Harlé and Co., of Paris, are exhibiting a 400-KW. turbo-alternator. This type of turbine has been previously fully described in the ELECTRICAL REVIEW, Vol. LIV., No. 1,386. The machine exhibited runs at 3,000 r.p.m., working with steam of 135 lb. (9 atm.) pressure. The type of alternator used

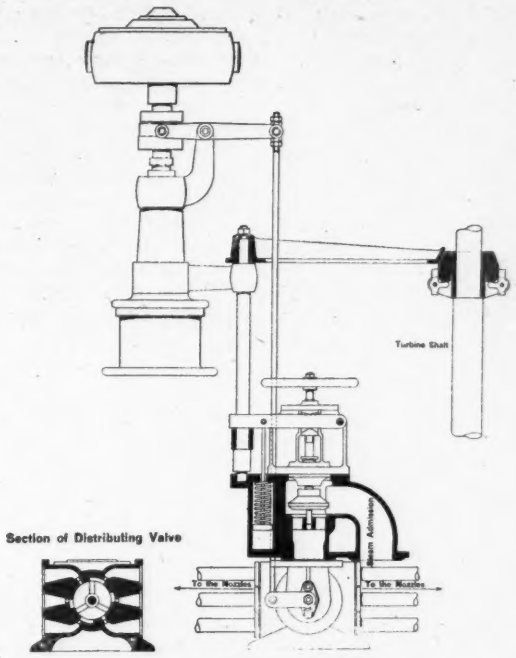

FIG. 7.

was adopted after exhaustive trials. The revolving field is built of laminated iron, wound symmetrically, and gives a perfectly sine-shaped E.M.F. wave. The alternator shown generates current at 3,000 volts; it is provided with Prof. Blondel's compounding device, and has two poles. Up to the present six Rateau turbines, aggregating some

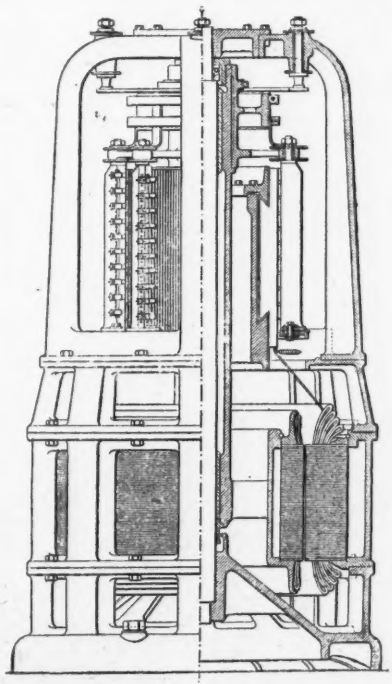

FIG. 8.

45,000 H.P., are installed, or in course of construction, this being a very satisfactory figure, considering that these turbines have only been in practical use since the middle of 1902.

The Société Egyptienne d'Electricité, of Paris, has a most interesting stand. It is showing three 150-KW.

rectifiers built according to the Rougé-Faget patents. Fig. 8 shows one of these rectifiers. Whereas the usual rotary converter has a stationary field and brushes and an armature revolving at synchronous speed, the armature and commutator of the Rougé-Faget rectifier are stationary, and the magnetic field and brushes revolve. Now, the revolving field is produced by the three-phase current to be converted, and therefore requires no special windings or core. The armature stampings are quite similar to those of the stator of an induction motor. The magnetic flux passes through a rotor which is placed in the centre of the stator, and which is fed with continuous current produced by the rectifier. Thus the rotor drives the brushes at synchronous speed. The current passes from the brushes to a pair of slip-rings, which are fixed to the rotor shaft, and thence through two sets of stationary brushes to the terminals. To make the machine self-starting, the rotor is also provided with a separate short-circuited winding, so that in starting, the rotor is no different to that of an ordinary induction motor. A speed little short of synchronism is soon attained, and then a rectified current passes into the second rotor winding and thus synchronises the rotor automatically. Of course, the current in the short-circuited winding disappears as soon as synchronous speed is obtained.

The whole arrangement is mounted vertically, and all the separate parts are shown in the two figures. Many advantages are claimed for these machines in comparison with rotary converters, and the makers hope that their novel design will give a fresh impetus to continuous current traction. Firstly, the weight per kilowatt is said to work out at barely half that of a rotary, and the price should be low in proportion. Though the power factor is naturally rather low at light load, it rises to well above 0·9 at full load for machines of 150 KW., and the efficiency also reaches satisfactory limits.

But the greatest advantage lies in the facts that the machine may be started by merely closing a switch, and in the safety on the alternating current side, two points which constitute the chief weaknesses of rotaries.

The cost for attendance will therefore be low, and it will probably be found practicable to install sub-stations of smaller output than is found economical where rotaries or motor-generators are employed.

The makers have taken every care to make the brush-holders as satisfactory as possible, but they undoubtedly constitute the weak point of this machine. However, the rectifiers at Liége certainly worked quite sparklessly on load.

We have no figures at hand relating to pressure variation on load, but this will probably be found to be similar to that of a transformer, and here the older systems would appear to claim the advantage in a very important point for traction work.

The high-speed vertical steam engine, which is such a common feature of our own central stations, does not enjoy the same popularity on the Continent, and very few engines of this type are to be seen at Liége. The Société Anonyme des Bellevilles, of Saint Denis-sur-Siene, are showing a 500-H.P. triple-expansion engine running at 375 r.p.m., and fitted with piston valves. This engine is designed to work with superheated steam, and forced lubrication is used throughout. It is direct coupled to a three-phase alternator built by the Société L'Eclairage Electrique, of Paris, the output being 450 K.V.A. at 3,000 volts and 50 cycles.

A special feature of this alternator is the fact that the armature windings are laid in entirely closed slots, thus giving a nearly pure sine-wave. The pressure regulation is very satisfactory, the drop of voltage at full load with as low a power factor as 0·6, not exceeding 12 per cent.

The same firm are also showing the armature of a 1,500-K.V.A. alternator, which is quite similar to that of the smaller machine.

The space occupied by English engineering firms is decidedly modest. As far as we could see not a single English electrical manufacturer is occupying a stand. Messrs. Alfred Herbert, Ltd., of Coventry, are showing some of their well-known up-to-date machine tools, and several other firms are also showing workshop machinery, mostly electrically driven.

The stand of Messrs. De Laval, of Stockholm, is not situated in the Machinery Halls, but in the Swedish section. Of their numerous exhibits, we may mention a 30-H.P. turbine direct coupled to a continuous current dynamo. A turbine of the same size drives a centrifugal pump, capable of raising 3,000 litres (650 gallons) per minute through a lift of 25 metres (82 ft.).

Messrs. De Laval are now making a speciality of their centrifugal pumps; the largest of those shown is a multi-cellular pump raising 180 gallons per minute, to a height of 460 ft. when running at a speed of 1,440 r.p.m., and is driven by a 50-H.P. three-phase motor. A very compact little electric generating set consists of a turbo-dynamo running at 4,000 r.p.m., with an output of 12·5 amperes at 65 volts. These sets are primarily intended for ship lighting, and are said to have found a ready market.

The electrical plant shown in connection with Messrs. De Laval's machinery was supplied by the General Electric Co., of Sweden, whose English manufacturing agents are the Fuller-Wenstrom Co., of London. This firm is exhibiting continuous-current and three-phase motors ranging in size from 2 to 70 H.P. The induction motors are simply constructed, mechanically, and the question of ventilation has received the makers' special attention.

One motor is entirely enclosed and waterproof, and one is provided with a brush-lifting device. This firm has supplied the electrical plant for most of the large Swedish iron works.

From the above it will be seen that though the Liége Exhibition shows the continued progress of mechanical engineering, and particularly the striking advances of the gas-engine industry, it can hardly be called representative as regards the electrical industries of to-day.

In conclusion, we should like to express our thanks to those firms and their representatives who have kindly furnished us with particulars and drawings, or photographs of their exhibits.

INTERNAL COMBUSTION ENGINES.*

By DUGALD CLERK, M.Inst.C.E.

THE internal combustion engine being a heat engine in which the working fluid is air and the fuel inflammable gas, it differs from the hot air or steam engine in that the heat to supply the motive power is given directly to the working fluid by combustion in the cylinder.

The advantages of the air engine over the steam engine have long been recognised, and many distinguished engineers have devoted much time and study to the theory and practice of developing motive power by the agency of heat.

Even so long ago as the middle of last century the opinion existed that air engines should be more economical of fuel than steam engines; however, the difficulties in connection with its practical development proved too great, and the air engine proper has made no real advance.

The leading obstacle was the slow transfer of heat through metal to air, and attempts to obviate this failed through loss of heat in passing through valves, and the want of gas-tight valves that would withstand heat.

In the case of the modern internal combustion engine, the method of heating by explosion within the cylinder, disposes of all the former troubles, the difficulty of heating even great masses of air is quite abolished, and when the air is once heated cooling is slow, while the larger the mass of air heated the smaller is the relative cooling or heating surface.

A prominent feature of the modern engine, whether using coal gas, petrol, alcohol or producer gas, is the compression before combustion, the true function of which even now is not always understood.

After referring to the "stratification" fallacy, the author states that the true theory of compression was first enunciated by him in 1882, when he pointed out that compression gave a cycle of operations having a distinct thermo-dynamic advantage, apart from consideration of heat losses.

* Extracted from Cantor Lectures delivered before the Society of Arts on February 13th, 20th and 27th, and March 6th, 1905.

An engine operating on the Carnot cycle, having a maximum pressure of 500 lb. per sq. in. absolute, and using pure air as working fluid, would have a mean pressure of

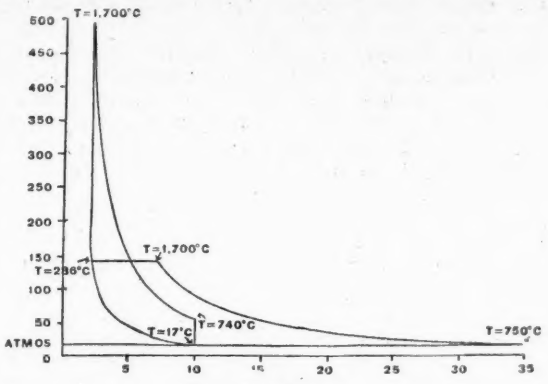

FIG. 1.

6 lb. per sq. in., maximum temperature 633° C., and efficiency according to $\frac{T - T^1}{T} = 0{\cdot}64$.

An engine working by air on the Otto cycle, with the same maximum pressure, would have a mean pressure of 105 lb. per sq. in.; $\frac{1}{r} = \frac{1}{5}$; efficiency, 0·48; maximum temperature, 1,700° C.; compression temperature, 286° C.; exhaust temperature, 740° C.; minimum temperature, 17° C. $P\,V^{1{\cdot}408}$ = constant assumed.

In this case the cycle is a practical one.

With the same maximum pressure, but with heat added at constant pressure and discharged at constant volume, the

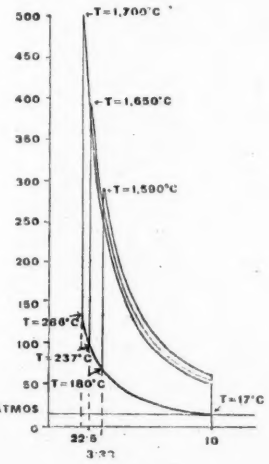

FIG. 2.

mean pressure would be 117 lb. per sq. in.; compression temperature, 630° C.; while the maximum temperature, exhaust temperature and minimum would be the same as in the last example, but $\frac{1}{r} = \frac{1}{12{\cdot}24}$; and efficiency 0·61.

Comparing air engines working at constant volume and constant pressure, giving the same efficiency, the diagram (fig. 1) gives:—

	Constant volume.	Constant pressure.
Maximum temperature ...	1,700° C.	1,700° C.
Maximum pressure ...	500 lb. per sq. in.	141 lb. per sq. in.
Mean pressure	105 „	37 „
Efficiency	·48	·48

In these cases the same efficiency formula has been applied, the efficiency depending on the compression ratio only, as first recognised by the author in 1882. Comparing further the Carnot, constant volume and constant pressure diagrams, the author points out that the constant volume cycle is the one most generally adopted, while only the Diesel oil engine works on the constant pressure cycle. To show graphically the fact that as compression increases greater conversion of heat into work results, the diagrams shown in fig. 2 are given for Otto cycle air engines at different compressions.

	Maximum pressure per sq. in.	Mean pressure per sq. in.	Efficiency.
$\frac{1}{r} = \frac{1}{5}$	500 lb.	105 lb.	0·48
$\frac{1}{r} = \frac{1}{4}$	391 lb.	101 lb.	0·43
$\frac{1}{r} = \frac{1}{3}$	287 lb.	97 lb.	0·36

Other values for efficiency calculated on $E = 1 - \left(\frac{1}{r}\right)^{·408}$ are:—

$\frac{1}{r} = \frac{1}{7}$	·55
$\frac{1}{r} = \frac{1}{10}$	·61
$\frac{1}{r} = \frac{1}{20}$	·70
$\frac{1}{r} = \frac{1}{100}$	·85

showing the large thermo-dynamic gain by increased compression.

Increase of compression increases the pressure generated, thereby reducing the bulk of the engine, and diminishes the heat losses.

Referring to the increase of pressure due to heating air in a closed vessel as being $\frac{1}{273}$ for each degree C., the author illustrates apparatus used by Prof. Bunsen in 1866, and himself later, to measure the pressure developed by explosive mixtures, which proved that gaseous explosion produces a maximum temperature of about 2,000° C. with a pressure of 100 lb. per sq. in. above atmosphere.

However, after allowing for chemical expansion or contraction, there is always found an apparent suppression of part of the heat at the maximum temperature from that shown by calculation if specific heats are assumed constant, varying from 30 to 50 per cent., depending upon the strength of the explosive mixture, the greatest proportion being accounted for with mixtures between maximum and minimum strength. In the constant pressure cycle the heat loss is somewhat less than in the constant volume cycle.

Comparing actual diagrams obtained from constant volume engines with theoretical diagrams, the differences are:—

1. The working fluid gains heat on entering the cylinder, when it would be better for it to remain at its lowest point.
2. During compression there is a certain amount of heat loss to the cylinder.
3. The supply of heat is never instantaneous.
4. During expansion considerable heat loss occurs.
5. The working fluid does not behave as a perfect gas.
6. Loss through fluid friction occurs.

On the charging stroke, the mechanical loss is due to throttling during admission and physical loss due to heating of the charge entering the cylinder.

While the effect of throttling may not exceed 1·5 to 2 lb. per sq. in., or about 2 per cent. to 3 per cent. of the indicated power, the effect in reducing the charge weight means reductions from 10 per cent. to 20 per cent. respectively.

To secure the greatest possible charge in some engines the inlet valve does not completely close till the crank has passed from 30° to 40° beyond the dead centre. Loss due to the heating of the incoming charge is frequently such as to reduce the power by 22·5 per cent., or 0·344 per cent. for every degree rise above 17° C.; the moral is, therefore, keep everything as cool as possible. During compression the least loss would be attained by keeping down the wall temperature.

At ignition the object is to make the heat addition as quickly as possible without producing shock to the engine, and not igniting so early as to allow the flame to be exposed for so long a period as to cause the expansion curve to fall.

What occurs on the expansion stroke is much more complex, and we will only give the main features.

That heat is added during the expansion stroke is generally admitted, but opinions differ as to the explanation of the phenomenon.

Proceeding to consider actual diagrams, those from a National Co.'s engine of 14 in. cylinder diameter × 22 in. stroke are examined. A light-spring card showed 1½ lb.

below atmosphere on the charging stroke; the cylinder nearly fully charged with gas and air, and a mean back pressure on the exhaust of about 2 lb. per sq. in.

A heavy spring diagram from the same engine showed :— Mean pressure, 94·5 lb. per sq. in. (rich mixture), 57·5 B.H.P.; maximum temperature, 1,710° C.; exhaust temperature, 1,000° C.; temperature of compression, 440° C.; temperature of charge before compression, 90° C.; indicated efficiency, 33 per cent. The distribution of heat was approximately :—

Indicated work...	33·1	57·5 B.H.P.
Jacket loss	36·0	
Radiation	6·0	
Exhaust	42·0	
	107·1	

The reason of the over-balance is that part of the heat set down as exhaust does not really get away from the engine. Though the indicated efficiency was 33 per cent., and the brake efficiency 28 per cent., it was stated that with a weaker mixture an efficiency of 35 per cent. could be obtained, but with a very weak mixture the card gave :—

Maximum temperature, 1,250° C.; mean pressure, 85 lb. per sq. in. Indicated efficiency, 29 per cent.; brake efficiency, 25 per cent.

Comparing the efficiencies obtained with a normal gas supply with the standard air engine having the same clearance, the actual cycle ranges from 0·6 to 0·7 of the ideal.

A number of diagrams from different engines using coal gas, producer gas, blast furnace gas, petrol and oil were discussed, the principal particulars being given in the following table :—

Engine.	Cylinder. Dia. ins.	Cylinder. Stroke, ins.	Estimated suction temperature, °C.	Maximum temperature, °C.	Average speed per minute.	Mean effective pressure.	Indicated horse-power.	Brake horse-power.	Indicated thermal efficiency.	Fuel gas, &c.
Crossley two-cylinder ...	18½	30	100	1,530 1,470	172	77·5 81·5	273	253	30·3	Manchester gas 607·5 B.TH.U. per cb. ft.
—	6	12	156	1,948	200	69·7	—	—	19	
National ...	10	18	100	1,690	170·3	89·6	26·4	23	28·7	
Stockport ...	20	27	100	1,200	182	72·5	141	—	—	Wilson producer gas.
„ ...	18	27	100	1,220	180	77·2	113	—	—	„ „ „
National ...	—	—	100	1,560	170	84·4	—	32	—	Dowson suction gas.
Premier ...	28⅛	30	50	1,650	128	110·4	—	—	—	Mond gas.
Cockerill ...	29¼	35½	100	1,390	98	72·6	810	—	—	Blast furnace gas.
Air-cooled bicycle motor	—	—	—	—	1,850	60	1·65	—	—	Petrol ¾ load.
	—	—	—	—	1,580	70	1·65	—	—	„ full load.
Hornsby 25-H.P.	—	—	—	—	—	57	—	—	—	Heavy oil, maximum power.
	—	—	—	—	—	45	—	—	—	„ working load.
National ...	—	—	—	—	221·6	58·5	—	—	—	Heavy oil, ·736 lb. per B.H.P.-hour.

In all these engines, if the compression space be known, and the efficiency calculated from the formulæ for constant volume engines using air without heat losses, if the efficiency be multiplied by a factor between ·6 and ·7, the practical efficiency will be given.

The extent to which the compression can be practically increased, is limited by the temperature at which ignition will occur; for coal gas it is unsafe to exceed a compression of one-fifth.

(*To be concluded.*)

THE SUPPLY OF ELECTRICITY OUTSIDE A DISTRICT.

[From Our Legal Contributor.]

A legal query was recently addressed to the editors of the Electrical Review which raised a question of some importance to supply companies—namely, when, and under what circumstances are "undertakers"—to use a phrase which includes local authorities and companies who supply electricity—entitled to give a supply to consumers outside their district? In the query referred to, it appeared that a works which required a supply of electricity was situated close on the border-line between two districts. The generating station of the undertakers in whose district the greater part of the works was situated, was at a considerable distance, while the generating station of the other district was close by. Certain cottages attached to the works were over the border-line. It was suggested that the requisite supply might be given through a cable laid to these cottages, from which it could be sent over the border to the works. The opinion expressed in the "Legal Query Column" was that, assuming the undertakers had no power to give a supply outside their district, it would be an evasion of the law to adopt the procedure above suggested. With reference to this reply, a correspondent writes as follows :—

> Suppose that half a mill is in A's area, and a half in B's area, now if A supplies, cannot the mill owner put a motor in A's half which drives a shafting carried through into B's? or must he cut his shafting in half, and have two motors, one supplied by A, and the other by B?
>
> Again, suppose A supplies a motor-generator in his half, cannot the generator drive through shafting, or through other motors, B's half? This arrangement is equivalent to the mill owner putting down, say, a steam-driven plant in A's half, only the steam engine is replaced by a motor which is supplied with electricity by A. As regards the gas company's case cited, supposing the railway company put down a gas engine driving a dynamo, could they not light electrically the whole of their station? It occurs to me that putting in a motor-generater or a transformer, solves the question.

Leaving out of consideration the question whether the undertakers concerned will, or will not, stand on their strict rights in the matter, let us approach the question from the strictly legal point of view. The correspondent whose letter we print above, puts the case of a mill which is actually on the border line between two districts. In such a case it would be for the court to say, if the question were raised in proper form, whether to supply such a mill constituted a breach of the Electric Lighting Clauses Act, 1899 Schedule, Sec. 4. That section provides that (1) the area of supply shall be area named for that purpose in the special order; (2) the undertakers shall not at any time after the commencement of the special order supply energy or (except for the purposes of that order) erect or lay down any electric lines or works beyond the area of supply otherwise than under the authority of Parliament, or under a licence granted by the Board under the principal Act; (3) if the undertakers supply energy, or erect or lay down electric lines or works in contravention of this section, the Board may, if they think fit, revoke the special order on such terms as they think fit. What, then, constitutes a supply of energy beyond the area of supply? It is in each case a question of degree. In the cases above suggested, it is anticipated that no Court would decree that the supply should be given to a mill situated on the border line between two districts from the generating stations of both those districts. It would be optional for the consumer to take the supply from either undertaker. Where, however, a consumer situated near the border line extended his premises or built cottages across the border for the express purpose of taking a supply, it is apprehended that the undertakers in the district in which the mill was situate might legitimately complain. The use of a motor-generator in the manner suggested would amount to a colourable evasion of the Act. In other words, the exten-

sion of a works *pro hac vice* would be regarded with suspicion by the Court.

It has been necessary to deal with this question *a priori*, because there are no reported cases which touch the question in relation to the supply of electricity. It has, however, been raised in connection with the supply of gas—in the case to which our correspondent refers. In that case a gas company at the request of a railway company placed a meter on a part of a railway station lying within the company's limits, and through it supplied gas to other parts of the premises situated outside the company's limits and within the limits of another company. The Court of Appeal held this to be lawful on the ground that the sale and delivery of the gas took place at the meter; but the House of Lords reversed this decision, holding that the gas was supplied where it was consumed, and therefore that the company were transgressing their authorised limits (Gas Light and Coke Co. *v.* South Metropolitan Gas Co., 62 L.T. 126). It is suggested that the railway company might have used a gas engine to generate electricity, and that if they had done so the Court would not have held that the gas was consumed outside the district. This may be so; but where electricity is supplied the use of a transformer or a motor-generator for the purpose of keeping within the letter of the law would not appear to be justifiable.

It is somewhat remarkable that the Electric Lighting Acts make no provision for the purpose of meeting this difficulty. There must be large numbers of consumers who live on the borders of electric lighting districts. We can only conclude from the fact that there is no reported case upon the question under discussion that so long as some portion of the premises supplied are within the area of the supplying company, the opposing company do not care to interfere. Nevertheless, if premises are deliberately extended with a view to taking a supply from a particular station, there may be cause for complaint.

As regards the supply of electricity to railways and tramways, a difficulty must arise if some portion of the line is outside the district of the undertakers. In some cases this has been met by a special clause in the provisional order enabling the company to supply a railway which extends beyond their district.

IS THE WIRING CONTRACTOR DOOMED?

Referring to the recent articles on the above, a few words on the aims of, and work now carried on by, the Electrical Contractors' Association should be of interest to all members of the electrical profession.

In the early part of 1901 a meeting was held of contractors working all over England, with the object of combining the various local contractors' associations into one national association. This was effected at the end of 1901, and the first meeting was held in January, 1902, when the objects and rules of the Association were confirmed.

Amongst the objects there stated are the following:—"To procure the improvement of any existing laws, usages and customs which the Association may consider to be prejudicial to such trades, &c."

In this the Association has been most useful, as, in a number of cases both in London and the provinces, corporations who were competing with local contractors have closed such departments through the action taken by the solicitors.

As a case in point, the clauses in the London County Council (General Powers) Bill empowering borough councils to carry on contractors' work were thrown out by the House of Lords' Committee as a result of the opposition of the Association.

In addition to this, action is being taken with some of the larger country Corporations to stop them carrying on electrical contractors' work in competition with local contractors, and the Association will readily welcome any information from country contractors who are now suffering from this unfair method of trading.

The Association has also proved itself useful, in so far as it has been able to modify, to a considerable extent, the requirements of individual engineers both of supply companies and corporations. In a large number of cases these engineers have issued rules for wiring, and have put contractors to much unnecessary expense and annoyance in refusing to connect the installations because the contractors have not complied with all their requirements. The solicitors have carefully studied the different Electric Lighting Acts and Board of Trade regulations, and advise the members of the Association that these particular requirements have no legal sanction whatever, except in so far as they may happen to contain the regulations of the Board of Trade.

Cases have occurred in which the reputations of firms have been greatly injured through the reports made on installations by the officials of undertakers. Some contractors, of course, have only themselves to blame, although the high standard of efficiency aimed at by the members leaves very little to be desired at their hands. The instances referred to are cases of petty acts of tyranny on the part of officials as to the relative positions of the fuses, switches and meter. So far as the contractor is concerned, the want of uniformity (as to the order in which the same should be placed) amongst undertakers is the cause of much confusion and many disputes. The Board of Trade regulations do not give the undertakers any authority in respect of the points just mentioned. Firms of influence and position are singularly free from such oppression, as the official "armed with a little brief authority" has to be careful lest he should catch a "Tartar." It is the smaller firm that suffers the most, and there is no doubt that membership of the Association has been of great assistance to some in obtaining protection from and redress for such acts. It is very invidious for one firm to take up a strong attitude in a given district, but for an Association with solicitors, and an influential Council acting for unknown and maybe numerous complainants, the Association has a field of increasing usefulness. On the other hand, it is the aim of the Council and Association to improve the status and efficiency of the trade, and to prevent the incompetent from joining the Association, and thus obtaining the hall-mark of qualifications which they do not possess.

As an example of this, one of the members of the Association notified the solicitors that the undertakers' engineer refused to connect up some houses that he had wired because a 1/18 wire had been used instead of 3/22. The solicitors telegraphed to the undertakers pointing out that unless the installation was connected immediately, they rendered themselves liable to a penalty of not exceeding £2 a day for refusing, and the houses were tested and connected within four hours of the receipt of that telegram.

Cases of this kind are happening nearly every day, and in each case the action taken by the Association has resulted to the advantage of the member.

Another object is to "Promote excellence in electrical work and just and honourable practice in the conduct of business and to suppress malpractice, &c."

To attain the first of these objects, monthly meetings are held, when papers are read and discussed, and questions relating to quality of material and excellence of workmanship are ventilated.

During the coming winter session it is proposed that papers should be read by a leading manufacturer of the different classes of materials used by contractors, such as cables, secondary batteries, lamps, motors, &c., and every maker will be invited to attend, so that a discussion can be held during which questions can be asked by members who have experienced any difficulties in the course of their businesses. The object of these meetings is to bring about better relations between the contractors personally by bringing forward and discussing any points of difficulty that each individual contractor may have met with, and it very often happens that valuable hints are given and received to the great advantage, not only of the contractor interested, but also of the client for whom he is working.

With regard to the latter part, a joint Committee consisting of members of the Manufacturers' Association and the Contractors' Association has been formed, to which cases of unfair trading on either side are brought, and it reflects credit on both Associations when, as in a case where a verdict was given in which costs were allowed, the amount involved and the costs were promptly paid.

The members of the Association last year considered that they were sufficiently numerous to obtain statutory powers, and therefore applied to the Board of Trade. The incorporation was granted in September last, with powers to carry on the work of the old Association, grant Fellowships, institute Scholarships, and initiate Benevolent Societies.

The great advantage of such incorporation is that the Association is now a legal body, with full power to carry on any business that a limited company can carry on, with the exception that no profit must be made. The Association is governed by a Central Board, which acts in a similar way to the directors of a company. This Central Board is composed of delegates elected from the Councils of the different sections, which again are composed of members elected from the different branches throughout the kingdom. By the sectional meetings, the whole of the contractors throughout the country are kept in touch with what is happening in different parts, thus enabling the Association to act as a body in all cases of difficulty, or where any individual contractor is molested either by the unfair competition of corporations or by the idiosyncracies of station engineers referred to above.

It is naturally the wish of the members to make the Association as strong as possible, and this can only be done by contractors joining and assisting in the work, either with personal efforts or by the influence of their name. Assistance of both kinds will be highly appreciated, and as in helping others one necessarily helps himself, no further inducement ought to be necessary.

However, should any contractor desire to hear details of the financial benefits accruing from membership, the hon. secretary, Mr. Leonard G. Tate, of 20, Bucklersbury, London, E.C., will doubtless be pleased to point them out.

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Olympia Exhibition: Free Tickets?

Would you permit me to use your columns for the purpose of reminding the various corporations and district councils interested in electricity undertakings that about this time last year the gas companies and their allies were scattering tickets of admission right and left for the gas exhibition at Earl's Court, with the obvious view of letting all their customers, *ex-customers* and prospective clients see the latest developments in the gas world. The electricity supply companies we can safely trust to look after their own interests in matters of this kind; the question is, will the public bodies already referred to see the wisdom of copying the tactics of the gas companies, to the extent of sending out tickets of admission to likely consumers for the forthcoming Electrical Exhibition at Olympia?

C. Rockley.

West Ham Corporation Electricity Department, Canning Town, E.
September 24th, 1905.

Some Arithmetical Questions for Mr. Byng.

Art—and the fiscal question—being long, and life—and leisure—short, I am unable just now to discuss with Mr. H. W. Wilson the theory of foreign exchanges, which, however, are not the simple matter he so glibly represents, but a more complicated affair, such as that by means of which the payment of the interest on capital (or loans) advanced to a self-governing colony may reach this country in the form of scissors or toys, through the following courses. The colony has a surplus, say, of a raw material like wool. German weaving firms buy this in the ordinary course of trade, and remit its value to London in the shape of manufactured goods. The manufactured goods which Mr. Wilson would combat by a preference come either in the manner indicated, or else more directly in return for our coal or for manufactured goods; *but, in any case, only because there is a demand for them here.*

Yes, something is wrong, and will remain wrong so long as we consider imports and exports to be the only measure of our economic and financial condition. If we persist in sticking to two dimensions, when three are needed, is it to be wondered at that when "something is wrong," Brummagem or Berlin policies are recommended by those unaware of the fact that imports and exports alone do not tell the whole truth? Why not the third dimension, namely, an enumeration of the volume of internal commerce? When exports and imports can be shown in their proper relation to this, it will be time, if present theories be then repeated—which is very dubious—to deal more fully with heresies as contrary to economic truths as perpetual motion is to the conservation of energy.

W. Pollard Digby.

London, W.C.,
September 19th, 1905.

Inspection and Testing of Tramway Overhead Equipment.

I see that in your issue of September 15th, Mr. Tweedy and Mr. Dudgeon both refer to my method of testing the insulation. In one letter it is termed a luxury, which would suggest that it is regarded as the best of its kind, but too expensive a method for ordinary practice. As the flipper can be attached to an ordinary car if necessary, it only requires the attendance of one man to watch the instrument reading, and therefore cannot entail great expense. I do not quite follow why the flipper arrangement is more open to "carelessness and error" than the slower method with the fork. I suppose the insulation of each insulator is tested perhaps three times more often per week with my arrangement.

I am, of course, aware that each system must discover the means for testing most suitable to its own local conditions; at the same time, in my opinion, the methods which remove faults in the shortest time after they have developed should be the best.

A. H. Pott.

London, *September 23rd*, 1905.

Telephone Amenities.

I fully sympathise with Mr. W. R. Adams; I have the National Telephone instruments both in my works and in my private house.

From my works I very frequently have trunk calls to London and elsewhere, from my private house I do not suppose I make three calls (except locally) in the year. I pay the usual deposit of 1 guinea on my works' instrument, and yet because I refuse to pay a deposit of 1 guinea on what would probably never amount to more than a shilling or two, and although I have been a subscriber for many years, the telephone company refuse to put me through to the Post Office for any calls I may wish to make from my private house. I agree with Mr. Adams, it is "attempted blackmail."

Henry J. Rogers.

Watford, *September 26th*, 1905.

Money for Nothing.

I should esteem it a great favour if some of your more educated readers could tell me what the electrical profession is coming to. The following are a few of the questions taken from a list sent out by a well-known Town Council for the post of junior engineer in their power station:—

State particulars of technical and electrical engineering training and period served in the shops. State particulars of theoretical training, giving list of certificates held.

Has applicant had under control, and does he thoroughly understand the following:—

(*a*) L.T. vulcanised bitumen, paper-insulated cables laid solid, also H.T. lead-covered steel-armoured cables.

(*b*) Lancashire boilers, stokers and superheaters, surface condensers.

(*c*) High-speed double-acting engines, polyphase generators.

(*d*) H.T. lighting and D.C. traction boards, including synchronising and parallel running.

(*e*) Rotary converters with their transformers.

(*f*) Testing instruments, calibration and meters.

Has applicant been accustomed to shift in high-tension power house? If so, where, and for how long?

The wages that the lucky individual will receive for the above is the magnificent sum of 28s. per week, or about the same as an ordinary navvy would earn that knows practically nothing. It seems to me that in another two or three years' time borough engineers will want a young Edison or Kelvin for about 17s. 6d. per week. I should also like to know what encouragement there is for a young man to go through the course advocated by your correspondents "Common Sense" and Mr. Schwartz, when there are such *good* salaries being thrown about.

Sub-Station.

Oerlikon Generators in Dublin.

I read your description of the Pigeon House Fort Electricity Works, Dublin, in your issue of 8th inst. with great interest, and would be much obliged if you would kindly find room for the following additional remarks in connection with the above plant.

It will no doubt be interesting to some of your readers to know that the generator which has been manufactured at Witton is really of Oerlikon design.

The fact that the Oerlikon Co. has long since found and employed a far more effective means to secure a pressure wave almost covering the ideal sine curve, than the increasing of the number of slots per pole and phase, though probably generally known in engineering circles, might here be shortly referred to.

I have much pleasure in enclosing herewith a photo of a 2,350-K.V.A. high-speed rotor which shows the pole-pieces so arranged that their edges do not travel in a parallel line to the shaft through the magnetic field, and the result of this very simple mechanical alteration is fully illustrated in the blue print, which shows the calculated sine curve and the measured pressure wave.

For some time the Oerlikon Co. have carried out all their generators on this principle, and no doubt the troubles due to badly shaped pressure waves can be considered as a matter of the past.

By-the-bye, the two 1,000-KW. and the two 500-KW. high-tension four-phase generators erected at Dublin were designed as far back as 1892 to 1900 in the factories of the Oerlikon works in Switzerland.

Electrical engineers who have followed closely the progress made during this time will agree that the past five years represent ages in the electrical world.

G. Wüthrich.

London, *September 25th*, 1905.

[The Oerlikon design of pole-piece, and the resulting sine curve of E.M.F., were illustrated in an article by Mr. C. C. Paterson in our issue of January 29th, 1904.—Eds. E.R.]

The Wiring Industry.

The question of the wiring industry is, in the writer's opinion, one of the most difficult to deal with at the present time, and is one which there appears to be no very quick and easy means of solving, owing to the fact that the whole industry is in such an unsatisfactory state, which state has been brought about by various influences in different directions.

Although individuality, as suggested by Messrs. Nicholson and Co., may play a slow and definite part in the uplifting of the trade, I think we shall also have to look to other sources.

What has been the means of bringing the trade to its present state? With Mr. Munro, I say over-competition, and must also add, depression in trade generally.

Now, what is this over-competition, and how can it be stopped?

Much of this competition has been brought about by all kinds of traders, such as plumbers, ironmongers, decorators, &c., taking up wiring work, and these people are able to get as good terms from the manufacturers as the genuine electrical contractor, who has to rely on the electrical work to make a living, to find his men work, and to pay wages, rent, rates and taxes.

What chance has the electrical man against such a host of jerry workers in his own line, who sacrifice quality for cheapness when buying and carrying out work? Of course, all the fault does not lie with this class of so-called electricians, but partially with a short-sighted public who place their orders with them; and the manufacturers cannot be let off scot free for supplying every Dick, Tom and Jack with goods on equal terms with the trade, providing the said person speculates half-a-crown for 50 business cards.

Regarding corporations and supply companies, I hold that the contractors are their best friends, and, in many instances, are the people that get the least consideration.

The contractors are the people that spend a great deal of time and money in canvassing, estimating, and in general in pushing electricity supply, and adding consumers to the supply mains, for which services no appreciation is forthcoming, but very often a stumbling block is put in the way. No doubt a combination of first-class contracting firms might do a little towards mitigating some of the evils, but as for the wiring industry in general, it is probable it will have to work out its own salvation, a matter which will be a process of time.

H. Moss.

Huddersfield, *September 19th*, 1905.

The leader which appeared in your paper some little time ago, in which the writer took a very sombre view of the general position of the electrical contractor, undoubtedly affords grounds for serious thought. At the same time it appears to me that the picture drawn is somewhat too pessimistic, and I quite agree with Mr. Munro that there is no good reason why, if initiative, tact, and resource are displayed, contractors need, after all, have any grounds for serious disquiet.

It is, I think, fairly common knowledge that manufacturers draw a very thin line of demarcation between wholesale and retail trading, and the subject is one which ought, in my judgement, to be boldly tackled by, say, the Electrical Contractors' Association. With regard to this Association, it does not appear to be particularly desirous of enrolling new members, and so far as I have been able to ascertain, it really makes no efforts in this direction. About two weeks ago the writer sent a representative to the offices of the secretary asking to be furnished with the memorandum and articles of association and other particulars. The secretary was not in, and so far as could be gathered from the explanation tendered, the memorandum and articles of association were out of print. An assurance was, however, given that the necessary information would be forthcoming, which, however, has not as yet been implemented.

The E.C.A. should be, and no doubt up to a certain point is, a very useful organisation indeed, but it is evidently somewhat lethargic in its movements.

H. B.

London, *September 25th*, 1905.

That "plumbers," gasfitters," and "ironmongers" secure a large portion of lighting, telephone and "bell" jobs, say, up to 50 points or over, is an established fact, and that they are ever increasing their "footing" is well known to electrical contractors. Why? Not entirely due to the clannish spirit of a section of the community, as your correspondent, Mr. A. Hall, of Grimsby, seems to fear; that, however, may lay a minor claim, in some instances.

The public are now the factor we have to consider in this case, "they are the consumers," without whom electrical men neither "competent" nor "incompetent" would be required; moreover, no existing electrical organisation has any appreciable influence over them, which in the first case is exactly what is required, before we could limit the sphere of activity of the above-mentioned tradespeople, or skilled electrical labour gain the recognised standing it should have.

We also have to deal in the case of lighting with a powerful rival known to canvassers for Electric Supply

Co.'s as the "sometimes infallible gas mantle," which is urged upon the public with all its advantages, with some life and vigour—exactly what is needed by electricity. The latter has come to stay, and to be successful must be a "household word" for lighting and other industrial purposes. It must be impressed upon the "public" that it is actually a necessity and a source of pleasure if installed on the efficient and economical plan by firms of repute and at reasonable prices. On the other hand, it is a source of undoubted annoyance and risk when installed on the cheap plan, *i.e.*, "the ultimately more expensive plan" by these jerry contractors with their inferior labour and material; this has shaken the very foundation of the trade from time to time. There are men that would have it: "The public require the jobs done cheap!" Certainly they do, obviously they don't know good work from bad, it has never been well introduced on the right basis; cheap jobs are the very existence of such contractors, they cannot be blotted out by capital, the job comes out a good test for the time being; this satisfies the supply companies who do sometimes employ engineers, so called, that require the same weeding out process! Consumers are perfectly satisfied with the condition of affairs—until the trouble begins and with that expense. "The electric light is unreliable, and other electrical apparatus no good"—so goes the talk with consumers and their friends that perhaps would be consumers under more favourable conditions. No blame attached to the firm that did the work, of course the men finished their work quickly, and lights, &c., went well at first; they get along to the fault after a reasonable amount of humbug, and pronounce that "rats" have nibbled the wires, or other suitable excuse. That doesn't defray expenses, much less inconvenience. Can it be wondered, then, that the public are somewhat reluctant to use electricity at all? Of course there are broken gas mantles, but that is not so bad as a circuit fuse going and plunging a part of the shop or private house into darkness. Then the manufacturers are always pleased to secure fresh ground, and will supply any firm intending to go in for the business with any material at lowest possible prices, hence such persons can and do every day undertake to carry out work at 10s., and even lower than that figure, per "light complete."

I am speaking not of one town, but many provincial towns of the United Kingdom, from actual experience. The public or consumers, were they well acquainted beforehand, would not place orders with such contractors, for the sake of cheapness, and sacrifice reliability. In my opinion, there could be a successful issue in an organisation of manufacturers and contractors, not for "monopoly," but for the benefit of the whole electrical industry generally, by bringing and pressing the advantages and usefulness of electrical energy for industrial purposes generally before the eyes of the public—the actual buyers—and dispelling the existing idea of the would-be consumers, *i.e.*, the masses, that it is an expensive luxury and unreliable. Teach them in some plain, untechnical form its superiority and cheapness when installed on efficient and economical lines by firms of repute and with sound material at reasonable prices; it is then we may look for developments, and with twofold results—ever-increasing demand for energy and the jerryman abolished.

Caddick.

Dublin, *September 25th*, 1905.

An Overcrowded Profession.

I sincerely hope that the correspondence you are so kindly giving publication to at the present time in your widely-read journal on the all-important questions of the training of engineers, and the overcrowding of the electrical engineering profession by incompetent and insufficiently trained men, may come before some of our foremost public men, and induce them to speak out and tell the nation in plain words that we have not a college or institution within the shores of these islands where a complete training can be had in any one branch of engineering; and yet it has been mechanical invention and engineering skill that have placed us in the forefront of all the nations of the earth, and it is still on the engineering industries that our future prosperity must nearly wholly depend. Had it not been for the immortal Watt, George Stephenson, Arkwright and Faraday, and a few more of the great inventors, where would the wealth of England have come from? Is it not true that the British have taught the world engineering, and is it not also true that the nations who have learnt from us are now drawing upon us, and doing their best to outstrip us by the systematic and advance methods they employ in the training of their sons?

If students can train for the medical profession and for the law, and gain their degrees of qualification in London, Edinburgh and Dublin to practice, surely there should be a few or more large training colleges in this country where a complete technical and practical training could be given in every branch of engineering, either by having engineering workshops as well as laboratories attached, or by being in connection with most of the big engineering firms, to which firms the students could be sent for two or three years' practical work for a fee or for free services. After a five or six years' course at one of these State recognised training establishments, the student could be sent forth with his certificate in hand as a duly qualified man, and with the right to write his profession after his name. The engineering institutions must confess that their diploma of membership does not count for qualifications or training; but I have said this before, and it cannot, I think, be denied.

We surely want to see England keep ahead as the greatest engineering and manufacturing country of the world, but if it once gets talked of abroad that our training is defective and inefficient, and that a better training can be had elsewhere, it will not be the engineering trade alone that will suffer, but the whole trade of the country. Where will the supply of properly trained men for the Indian railways and irrigation service be coming from when Cooper's Hill College is closed? Our young fellows are not to be blamed. They want the proper training, but cannot get it for either love or money.

The letters in the Electrical Review of the 15th inst. on the "Value of the I.E.E." and "Overcrowding" are to the point, and I think that Mr. Alfred Schwartz's able exposition on the training problem will be much appreciated by all who wish to see the electrical engineering profession upheld and better paid.

R. Browne.

Sidcup, *September 19th*, 1905.

That the profession is overcrowded, due to various causes, is no doubt true, but as you say all professions are in the same condition, so that we ought not to grumble.

To blame technical schools and colleges for not giving the right sort of education to fit a man to earn a large salary is very unfair. These places are doing a good work, and my experience shows that they do not devote all their energy to "examination cramming."

I had the pleasure of studying under Prof. Ayrton, and frequently we grumbled because he did not quite get through all the work mentioned in the syllabus. His reply was that he was there to teach us how to learn, not to cram us with facts. Most of us have already felt the benefit of this method, which should be, and I believe is, the aim of most technical schools, and I cannot help wondering what the "Practical Engineer" could do as a teacher. I do not think the most eminent men in engineering works would be found suitable to teach students how to learn and how to use their knowledge. This is the teaching necessary to train professional electricians, and can only be carried out by a specialist in teaching.

There seems to be a considerable misunderstanding as to the difference between trade and profession. If a man elects to be a professional man, he may have to sacrifice money for the self-satisfaction and status obtained by avoiding trade. It is quite incorrect to include purveyors of electrical accessories, wiring contractors, &c., when talking of the profession. These men do not require much knowledge of electricity, but are more likely than the professional to earn large salaries.

There is no doubt that parents consider the electrical

profession a *very* satisfactory one. This certainly is not correct, but surely it is as satisfactory as the chemical or other scientific professions.

P. G.

London, *September 25th*, 1905.

Your correspondents miss the real nature of the trouble : it is merely a case of the supply exceeding the demand, to which condition of the market there is little chance of improvement, owing to the attractions other than monetary of electrical work, and the superlative language employed by the man in the street and the Press generally when referring to electrical matters.

There is, however, Nature's law, the survival of the fittest (this not being necessarily the most technically-trained man), but for the present, owing to the crowd of more or less technically-trained mediocrities, good men have often to accept salaries equivalent to that of a daily labourer, in order to secure a chance of showing their capacity.

More technical education will not help this, as it does not prove a man's capacity, and a compulsory three or four years' training for everybody would not increase individual salaries unless it altered the ratio of supply and demand.

Neither are employers at fault for not paying more than the market price for services rendered. They generally require men of good common sense and great industry for certain specific duties, and they cannot be expected to take into consideration the fact that their assistants have possibly learned to do a lot of other things at a technical college.

Take the ordinary full course syllabus at a technical college : an average young man with an ordinary amount of common sense on leaving feels, after passing certain examinations, that he can take on several jobs, and thinks he ought to be paid in proportion. Unfortunately for him, he finds that he is only expected to do one job, and that exceedingly well, and that he comes into competition with some dozen others who can do that one job as well, or better, than he can from previous actual experience, and with good testimonials ; and as the qualities necessary to bring a man forward in the struggle of life are not at all the same as those necessary for passing examinations, employers put little faith in such examinations as a guide to a candidate's qualifications.

Technical education is not a cause of, but an aid to, success, and men "resourceful," original and with powers of "initiation" (inborn gifts), coupled with perseverance, will easily hold the lower rungs of the ladder with a very small amount of technical education, and will be quite certain to acquire sufficient further education along with their daily work to carry them well up to the top ; the top, however, from a monetary standpoint not being very high, as compared with other ladders to affluence and fame.

Capacity.

A Review of Reviews.

Referring to your review of "Practical Alternating-Current Testing," by C. F. Smith, in your last issue, "A. R." has hardly done the author justice in some of his extracts by omitting to read or give the context. For instance, in connection with the self-induction of a spiral, quoted from p. 51, the beginning of the paragraph reads as follows :—"The figures given above form a *useful rough basis* for estimating the self-induction of any resistance spiral, as the self-induction varies, . . . &c." As a rough basis for estimating the self-induction in an ordinary resistance frame, the consideration of the effect of the diameter of the wire employed, seems rather beside the mark.

Your reviewer's references to the coil which is in the terrible condition of being *without any self-inductance at all*, are both obscure and alarming.

The term "auto-transformer" appears to be the one in most general use in this country, and "A. R.'s" predilection for the more elegant, but somewhat topsy-turvy, expression of "bucking-down" is due, doubtless, to his classical upbringing.

Judging from the general line of the review, it would appear that your reviewer has hardly appreciated the aim or scope of the work. According to the preface, the book only professes to deal in an "elementary" manner with the principles of alternating-currents and alternating-current machines, and this it appears to do in a pre-eminently sound and lucid manner.

W. H. N. J.

Testing Rubber Gloves.

We see in the current issue of your paper a complaint as to the quality of the ordinary electrical rubber gloves, giving an air-pressure test, which is the means employed to discover defects. We have been testing our rubber gloves with 5,000 volts between water on the inside and water on the outside for the last three years, and after many experiments, have come to the conclusion that this is the only efficient method, since impurities are as likely to cause faults as pin-holes, with just as unpleasant results.

The St. Helens Cable Co., Ltd.

Warrington, *September 26th*, 1905.

Starting Steam Turbines.

On reading the remarks concerning turbines in your last issue, the question came in my mind, Are we making headway in our knowledge of steam turbines ?

In one article on p. 451, on "Central Station Design," we read that "the clearance between rotor and case is made so slight in order to exact the last fraction in steam consumption, that one constantly hears of blades stripping through too rapid starting." In other words, that the clearances allowed are calculated to such a nicety, that it is necessary to allow the turbine to take from ½ hour to 1 hour to obtain the requisite clearance by expansion, sufficient to allow the rotor and blades to revolve freely.

Further, in another article in the same issue, p. 465, on the recently installed turbines at Glasgow, mention is made that the blades are protected by shrouding, and that on several occasions the shrouds have actually come into contact with the case, and that with "no more serious result than at the point of contact a small portion of the shrouding has been ground off," consequently the carefully calculated clearance is increased, naturally reducing the efficiency in no small degree.

Surely the efforts expended in this country must have been in vain, if, after all these years, we have to acknowledge defeat in what appears to be the crux of one of the most important industries of the future.

I do not know if my fears are exaggerated, or if I am under a misapprehension, but should like to have other opinions on the matter.

Greaser.

[For the statement first cited we are not responsible. No doubt accidents have happened ; but it is a well-known feature of many steam turbines that they can be started from the cold and put on full load in the space of a few minutes without risk of injury.—Eds. E.R.].

Design of Instruments and Meters.

From time to time one hears of some more or less enterprising firm bringing out and developing some absolutely *new* feature in instruments and meters, which they, the manufacturers, try to make the electrical world believe is something very wonderful.

I refer to such schemes as the magnetic suspension and the use of ball-bearings for wattmeter movements. These schemes, as a rule, show a certain amount of ingenuity, but are really not by any manner of means improvements in the working of the meters ; they are merely "catchy selling points."

The latest freak in this direction is the "Inkless Recorder," which looks like the work of some over-wrought brain. I wonder if the makers imagine that switchboard makers and users wish to complicate unnecessarily the wiring of their switchboards.

The only advantage that can be claimed for this "improvement" is that no fluid ink is used, and therefore the instrument will not get splashed with ink. Of course if the instrument maker cannot make a suitable pen, one feels

some sort of sympathy for him, but let him try again before he brings forth such a monster as *the* "Inkless Recorder."

On referring to the Electrical Review of September 8th, 1905, on the above subject, we find that a feeble-minded youth is deputed to look after recording instruments, to splash the ink about. I presume that the same class of youth will look after the "Inkless Recorders," to put in the inking ribbons and fake up the relay contacts; those contacts! !—also occasionally to stir up the interior of the "grandfather's clock arrangement" supplied with the recorders.

In conclusion, I may say everyone is pleased to see improvements in this class of apparatus, but I think few of us have patience with folks who create unnecessary and undesirable complications in otherwise useful apparatus.

Mr. Editor, I am sorry to take up so much of your valuable space, but I think it is about time something was said about these questionable improvements.

O. K.

BUSINESS NOTES.

Lighting of the Potsdamer Platz, Berlin.—The appropriate lighting of the Potsdamer Platz, which is one of the most important and no doubt the most crowded thoroughfares of Berlin, afforded a difficult problem, which has recently been solved satisfactorily, from the point of view of both the electrical engineer and the architect. After thorough preliminary investigations into the local conditions and density of traffic in the square, it was found advisable to concentrate the illuminants on two highly-placed points, replacing the ordinary arc lamps formerly used by intensive "flame arc" lamps, characteristic features of which are the juxtaposition of carbons and the resulting downward emission of

Electric Lighting of the Potsdamer Platz.

light. Two poles 21 m. in height were accordingly erected on the two islands, each of the masts bearing four 20-ampere lamps of about 4,000 normal c.p. each, giving a total effect of about 32,000 c.p. The light is concentrated at points 18 m. high. The intensity of the lighting thus obtained allows the existing 11 12-ampere arc lamps to be dispensed with, while the square can now be inspected much more readily by passers-by. As the poles are used at the same time to carry the trolley wires of the tramcars, four trolley masts formerly used could be removed. The arc lamps were constructed by the Allgemeine Elektrizitäts Gesellschaft, the whole of the work having been carried out under contract by the Berlin Electricity Works.

Exports of British Electrical Machinery.—While the imports of foreign electrical machinery into this country appear to be on the decline, a slow but steady increase is taking place in the exports of British electrical machinery. The shipments in August last attained a total of £46,426, bringing up the value for the first eight months of the year to £433,459, as against only £306,729 in the corresponding period of 1904.

Consular Notes.—Italy.—In a recent report on the textile industry of Italy, the Austro-Hungarian Consul in Milan observes that water-power is more and more being employed in the industrial districts of Busto-Arsizio, Castellanza, Legnano, Gallarate and Somma Lombardo, where the great majority of the factories are run by the great water-power plant at Vizzola, and the producing powers of the factories are consequently greatly increased. Discussing the prospects of the Milan Exhibition of 1906, the Consul states that the difficulty of supplying the Exhibition with power, lighting, water and ventilation, has been successfully solved by the executive committee. It has been decided to use the electrical works already in existence in Milan, and to erect an electric station in the Exhibition ground in which the latest types of plant (steam turbine and suction gas) will be used. The power plant will be 2,000 h.p., and will include two combinations of suction gas motors of 300 h.p. (allowing for 500 h.p.), a superheated steam combination of 500 h.p., and a steam machine of 700 h.p. The contract for the erection of the filtering apparatus for the feed and other water required will be put up for international competition.

A company under the name of the Societa per la Fabbricazione di Apparati e Matebiali Elletrici has recently been established with headquarters at Naples. The company has for its object the manufacture and sale of electric insulators, telegraph and telephone materials and apparatus for electric industry and plants of all kinds. The capital of the company will be 100,000 lire in 100 shares, and the president is Prof. Michele de Palo.

An electrical company has been established under the auspices of the Bologna branch of the Banca Commerciale Italiana in combination with the Banco Fratelli Sangumetti. The company is named the Societa Esercizi Riuniti Imprese Elettriche Anonima, with head offices in Bologna, and with a capital of 1,500,000 lire. The object of the company is the construction and working of electric industrial plants, hydraulic works, aqueducts, tramways, electric railways, &c., and also the acquisition of certain similar undertakings already in existence.

Sardinia.—The Austro-Hungarian Consul at Milan reports that an electrical plant, the first of its kind to be used in Sardinia, has been erected at Montevecchio. The electric current is used for boring, ventilation, and ore mining and working.

Australian Trade Marks.—Messrs. W. P. Thompson and Co., patent agents, Liverpool, write as follows:—

Through the courtesy of a member of the Australian Parliament we have received a copy of the new Bill introduced by the Commonwealth Government for the registration of Trade Marks. It is in most important respects the new English Trade Mark Law which comes into force on April 1st next, amended slightly to suit Australian Institutions. There are, however, the following special points in it:—First, the proprietor of a trade mark registered in any state of the Union before the commencement of this Act is entitled to have his mark registered for the whole of Australia, but subject to the rights of other users or proprietors of a similar mark in any of the other states of the Union, and provided it could at the time when the Act came into force have been lawfully registered in the Australian state in which the trade mark was then registered and in use. If a mark has been publicly used by more than three persons or firms in any one state of the Union as a mark in connection with similar goods, it shall be held to be common to the trade, and therefore not registerable. There is a special section on Trade Union Marks, by which any Trade Union of workmen or employers registered under any law of the Commonwealth or of any state may register a mark as a Trade Union mark, only to be used by members of that Trade Union, and any person wilfully infringing the same is liable to a penalty of £50. A clause is inserted by which Australia can enter the International Union for the protection of patents and trade marks. The Act is admirably drawn up, and though certain members have given notice of a few amendments, chiefly verbal, it is practically certain to be passed this Session in almost exactly the form in which it has been entered, as the feeling appears to be unanimous in its favour. It is expected to come into force on January 1st next.

Neuhausen Aluminium.—The directors of the Aluminium Industry Co., of Neuhausen, have decided to increase the share capital from £640,000 to £1,040,000 by the issue of new shares of the value of £400,000, of which one-half is to be paid up. It is proposed to offer shares of the nominal amount of £268,000 to existing shareholders at the price of £100 per £40 share, while the remainder will be submitted for subscription, when a still higher premium may be obtained. At present, the share capital of £640,000 is only paid up to the extent of 50 per cent. It was originally £400,000, of which one-half was paid; in 1894 a second issue of £40,000, and in 1898 a third issue of £200,000, were made, each emission being 50 per cent. paid, and bringing the total paid-up capital to £320,000. Instead of calling up the balance of £320,000 on the three issues, it is now intended to proceed with the raising of the fresh capital in the same manner as in the past. This method is quite possible under the Swiss laws, but the German Company Acts prohibit the creation of new shares until the full payment upon the old shares has been effected. By, however, issuing shares in the way in question, the company is placed in possession of considerable funds arising from the premium alone, but which would not be obtained if a call were made upon the old shares. The fresh capital is intended for the extension of the undertaking and the establishment of new branches. Concessions have been granted for the utilisation of the water-power of the Rhone between Lenk and Siders and of the Navizance, and a power station of 50,000 h.p. is said to be in contemplation. In addition to this, it is stated that the company requires further capital for developing the Héroult method for the electrical production of steel.

Motor Contracts.—We understand that the works of Messrs. Harding Churton & Co., at Leeds, are full of orders, and that among the contracts on hand are the following :—

The Corporation of Croydon, for three single-phase induction motors, of the slip-ring type, to be direct-coupled to centrifugal pumps for the Norwood Sewage Farm.
Messrs. McCorquodale & Co., Ltd., for the installation of two-phase motors for driving their extensive printing works.
Messrs. Albion, Ltd., for the entire driving of their clothing factory.
Messrs. Whitley Partners (Leeds), a 45-B.H.P. two-phase motor (the fourth motor supplied).
Messrs. Bateman's Machine Tool Co., Ltd., a 25-B.H.P. two-phase motor (the fifth supplied).

Messrs. Harding Churton have also recently supplied their alternating current motors to the Corporations of Leeds, Sheffield, Huddersfield, Burton-on-Trent, Bristol, the Bournemouth & Poole Electric Supply Co. and others. The firm has just issued some revised price lists of single-phase motors (type I.R.) with high starting torque for direct coupling to lift-gear, cranes, &c.; also polyphase induction motors (two and three-phase).

For Sale.—Messrs. P. Huddleston & Co. will, on October 4th, sell by auction electrical testing apparatus (Nernst Electric Light, Ltd., in liquidation).—Harrogate Corporation is offering for sale a vertical compound steam engine and 40-H.P. Diesel engine.—A 220-KW. Reavell-Thames Ironworks steam-driven set is offered for sale. See particulars in our advertisement pages.

American Electrical Exports.—The value of the electrical appliances exported from the United States during July last is returned at £74,638, as contrasted with £73,922 in the corresponding month of 1904. There was also an increase in the exports of electrical machinery—from £98,674 in July, 1904, to £119,496 in July last. Canada is at present America's best customer for electrical machinery, being responsible for £48,414 of July's total, the United Kingdom coming next with £12,571.

Electric Motor-Cars for Buenos Ayres.—Messrs. B. Heinrich Scheele & Co., of Cologne, are reported to have secured an order for 30 electric motor-cabs for service in Buenos Ayres.

Dick, Kerr Contracts.—Messrs. Dick, Kerr & Co., Ltd., have recently secured the following contracts :—

James Kenyon & Son, complete generating plant and motors for driving spinning mills.
Cammell, Laird & Co., 300-KW. D.C. generator.
Wallasey U.D. Council, five single-truck cars with top covers, complete with electrical equipments.
Ashton, 500-KW. D.C. generator.
Star Paper Mills, complete generating plant and motors for driving the mills.
Buenos Ayres Port and City Tramways, 24 double-service cars and equipments; 10 combined freight cars and electric locomotives.
Cawnpore Tramways, 20 single-deck cars and equipments.
L.C.C., 16 single-deck steel cars, specially designed for L.C.C. subway.

Catalogues and Lists.—The Hart Manufacturing Co., 25, Victoria Street, S.W.—Catalogue B of "Diamond H" switches and wall appliances, contains illustrated particulars and prices of push-button and rotary flush switches, automatic door switches, steel wall frames and cases for switches. Several loose leaflets relating to the Hart devices have also been received.

Messrs. J. H. Holmes & Co., Newcastle-on-Tyne.—We have received a batch of catalogues and price lists relating to the firm's manufactures. The principal one shows a large number of excellent half-tone pictures of the Lundell and Castle continuous-current motors, describes in detail their construction, and gives directions for fixing, coupling-up to mains, and operation. Applications to driving various classes of machines are shown. Another list particularises the "Holmes-Page" patent quick-break chopper type switches, fuses of the replaceable bridge type fuses in cast-iron watertight boxes. The Holmes-Clatworthy system for electrical driving of machinery is detailed, and a list of newspapers, printers and paper mills employing the firm's motors and equipments are given. In other lists there appear the names of engineering firms, shipyards, railways and dockyards, also textile mills, steamships and yachts for which they have put in installations.

Messrs. Arch. Smith & Stevens, Janus Works, Queen's Road, Battersea.—A 36 pp. booklet received from this firm contains a good deal of interesting matter relating to their electric lifts for goods and passenger service. Methods of driving and control are discussed, and a comparison is made of electric with hydraulic power, figures being given of actual working costs, &c., at Birmingham, Dublin, London and Glasgow, the electric lift being the more economical. The illustrations show neatly the equipments for different patterns of lifts for working with single and two-phase alternating currents. The difficulties of working with single-phase are said to have been overcome, and lifts of this kind are now supplied direct-coupled, self-starting and reversing, and the results are highly satisfactory. A batch of users' testimonials appear, and a lengthy list of places in all parts of the world for which electric lifts have either been supplied or are now on order. These include the King's Apartments at the Epsom and Doncaster Grand Stands.

Messrs. W. Macfarlane & Co., Possilpark, Glasgow.—Catalogue (156 pages) giving a very fine collection of designs of their castings for electric lighting, ventilation and other work. One section comprises a selection of drawings of electric light pillars, brackets, &c., for arc lighting; another deals similarly with pillars and brackets for incandescent lighting; while the third is devoted to ventilation lamp pillars, columns and pipes. Engineers who are engaged from time to time with the question of public electric lighting, whether for wide or narrow thoroughfares or open spaces, will find in this catalogue, whose pages measure roughly 11 in. × 14 in., an ample variety of high-class artistic work for almost any position.

Messrs. Baughan & Co., London Street, Reading.—Illustrated pamphlet giving particulars and prices of flame, shunt, enclosed, photographic, and miniature arc lamps; arc lamps for stage purposes, resistances, carbons, and other accessories are also shown and detailed.

Messrs. Lionel Robinson & Co., Ltd., Ferry Works, Thames Ditton.—Collection of illustrated sheets caught together in cover with facility for adding later publications. These lists contain illustrated brief descriptions, and tables of prices relating to main switches, switch fuses, high tension oil switches and fuses, automatic circuit-breakers, switch boxes, measuring instruments, battery regulating switches, field regulators, &c.

Aktiengesellschaft fur Elektrotechnische Unternehmungen, München.—Several lists are to hand, as follows :—No. 11, particularising their lightning arrester with automatic spark extinguisher for continuous and alternating currents at voltages up to 650 volts; No. 13, describing a short circuiting device for high-pressure conductors; No. 14, showing the universal cap for tubular standards; No. 15, detailing junction boxes for house installations, of which 2,600 are in use on the Munich supply system; No. 16, describing automatic time switches for street and stair lighting, advertisement purposes and motors; No. 18, giving a description of Rennert's automatic fire alarm; and No. 19, devoted to the "Ideal" electric dark room lamp for photographic purposes. All of the lists are in English, and fully illustrated.

Messrs. Falk, Stadelmann & Co., Ltd., Farringdon Road, E.C.—New list of electrical fixtures supplementary to their general catalogues Nos. 191 and 202. It contains particulars of the new designs of brackets, pendants, standards, candle fittings, electroliers, and so on, which have been added to the firm's stock since the publication of the catalogue. We observe two very cheap and good lines of fittings, viz., a range of chain suspension electroliers, and an adjustable dressing-room pendant. Prices have been reduced for several of the lines included. The general catalogues mentioned above are still current.

A large number of catalogue notices are unavoidably held over.

Book Notices.—*Elementary Manual of Magnetism and Electricity.* By Prof. A. Jamieson, M.Inst.C.E. London: Chas. Griffin & Co. 1905. Price 3s. 6d.—This is the sixth edition of this well-known text-book for electrical teachers and students. As frontispiece an excellent reproduction of Acland Hunt's painting of Dr. Gilbert, showing his electrical experiments to Queen Elizabeth and her Court, has been appropriately employed. Additional figures have been inserted, with descriptions of various dry cells and accumulators, Lord Kelvin's volt gauge, &c., and numerous examination questions. The author rightly insists on the necessity of practical experimentation, without which a physical conception and permanent grasp of the phenomena discussed cannot possibly be obtained. The lucidity of Prof. Jamieson's explanations, and the eloquence of his illustrations, are alike admirable.

"Radium, Radioactive Substances, and Aluminium." By M. Metzenbaum. Cleveland Ohio, U.S.A.

"The Romance of Modern Mechanism." By Archibald Williams. London: Seeley & Co. 5s.

"Journal of the Institution of Electrical Engineers," No. 175, Vol. 35, September, 1905; index to Vol. 35, 1904-5; list of officers and members, corrected to August, 1905. London: E. & F. N. Spon. Price of No. 175 of the Journal, 5s.

"Practical Electric Wiring for Lighting Installations." By Charles C. Metcalfe. London and New York: Harper & Bros. 5s. net.

"A Technological and Scientific Dictionary." Part 10. Edited by G. F. Goodchild and C. F. Tweney. London: George Newnes. 1s net.

"Trattato di Telefonia." By B. Brunelli and E. Longo. Part 2. Rome: G. Scotti & Co. L1.25.

"Graphic Methods of Engine Design." By A. H. Barker. Second Edition. Manchester and London: the Technical Publishing Co. 3s. 6d. net.

"Vielfach-Telephonie mittels des Telegraphons." By J. W. Giltay. Reprinted from *Physikalischen Zeitschrift*. Leipzig: S. Hirzel.

Steel Tanks.—Messrs. Thomas Piggott & Co., pipe, tank, and structural makers, of Birmingham, have secured an order for 17 of their patent stamped steel tanks for South America.

Ediswan Lamp Bulbs.—A recent note regarding the manufacture of glow lamp bulbs in this country has elicited the information that the Edison & Swan Co. have always made, and are still manufacturing, their own glass bulbs at the Ponder's End Works. Not only are the bulbs blown, but the actual glass is also made at their works. It is gratifying to learn that this branch of manufacture can still be carried on in England, in spite of the severity of foreign competition.

Correction.—In reference to a catalogue notice which appeared on p. 419 of our September 15th issue, Messrs. J. C. Lyell & Co., Ltd., of 55, Victoria Street, S.W., write as follows :—"We notice you state that Messrs. Marx & Co., of 133, Finsbury Pavement, have been appointed sole agents for Great Britain for Messrs. Otto Schwade & Co., pump makers, of Erfurt, Germany, whereas under an agreement dated September 3rd, 1902, we are appointed the sole British agents for this firm. This agreement is still in force, and does not expire for some time to come. We should esteem it a favour, therefore, if you would kindly make the necessary correction in your next issue."

Colliery Cables.—In regard to the brief description in our last issue of the plant at the Douglas Bank Collieries, we are asked to state that the cables, which are insulated with Dialite vulcanised bitumen, are of the three-core type, and are wormed and packed with Dialite, so that no water can run down between the cores. These cables are all armoured with two layers of G.I.

wire, and we understand that so substantial was the make of the cable that in one case, where a fall of rock (over 8200 tons) occurred in one of the roads, the pump beyond the fall, which was worked by the cable, continued to work as if nothing had happened, and the cable, on being dug out, was found to be in quite a serviceable condition. The cables were supplied by the St. Helens Cable Co., Ltd., to the order of the Corlett Electrical Engineering Co., of Wigan, who were the main contractors.

Amendment of Specification.—Mr. V. A. Fynn gives notice of application to amend patent specification No. 22,712 of 1902, for "Improvements in and connected with alternate-current motors." See our advertisement pages to-day.

Trade Announcements.—Messrs. A. J. Wright, Ltd., have removed from 318, Upper Street, Islington, N., to larger and more convenient premises at Leyton Green Road, N.E. All communications should be addressed there.

Messrs. J. G. Statter & Co., of Cornwall Buildings, Newhall Street, Birmingham, are converting their business into a limited company under the name of The Switchgear Co., Ltd. The *personnel*, works staff, foremen, &c., remain unchanged.

Messrs. David Burns & Co., electrical engineers, have opened new showrooms at 18, Lowther Street, Whitehaven.

Messrs. Jeremiah Head & Son have recently completed arrangements with their principals in America for the formation of a separate English company, to take over their patents and entire business in Europe and the British Empire. The new company will be entitled "The Wellman-Seaver-Morgan Co., Ltd.," with offices at 47, Victoria Street, London, S.W. Mr. S. T. Wellman will become chairman, and Mr. Benjamin W. Head will be managing director. The designs of the various machines and specialities made by the American company will be supplemented in the future as new ideas are developed; these designs will be adapted to suit local conditions in the drawing office of the new company. Purchasers will thus combine the advantages of American designs, and the accumulated experience of the Wellman-Seaver-Morgan Co., with English workmanship. The company will supply charging machinery of all kinds for open-hearth steel-melting furnaces, and re-heating furnaces (vertical and horizontal) for iron and steel works; Wellman rolling open-hearth steel-melting furnaces; ladle cranes; ingot strippers (electric, hydraulic and combined); grab buckets for handling ore, coal, &c.; improved clutches for hauling and hoisting machinery; coke-oven machinery, &c.

The Cambridge Scientific Instrument Co., Ltd., Cambridge, notify that on and after September 30th their London office will be discontinued. All correspondence, thereafter, should be addressed to the works at Cambridge.

Morganite Brushes on Turbo-Generators.—Last week, referring to the Siemens turbo-generators at Glasgow, we mentioned that carbon brushes are giving extraordinarily satisfactory results on the two direct-driven dynamos, whereas they have hitherto been considered to be almost an impossibility on machines running at these high speeds. We now learn that the brushes in question are not what are generally known in the trade as "carbon" brushes, but are "Morganite" brushes, patented and manufactured by the Morgan Crucible Co., Ltd., Battersea Works, London, S.W.

Roller Bearings.—The Empire Roller Bearings Co. have secured the contract for supplying roller bearing axle-boxes to the Bengal-Nagpur Railway Co., for use on their heavy goods wagons.

Bankruptcy Proceedings.—Anthony G. New.—The sitting for the public examination of Anthony George New, electrical and general engineer, was held on 19th inst., before Mr. Registrar Giffard, at the London Bankruptcy Court. The accounts showed liabilities £19,740, of which £13,140 was expected to rank, against available assets £39. The case has already been reported. The examination was concluded.

Robert Pries.—Under the failure of Robert Pries, electrical sundriesman, carrying on business at 75, City Road, E.C., as Durtnall & Pries, the first meeting of creditors was held last week at the London Bankruptcy Court before Mr. Walter Bayle, Assistant Receiver. The receiving order was made on the joint petition of Mr. Julius Peltesohn, formerly trading as Hans Neuman & Co., and of John W. Sutcliffe & Co., Ltd., the act of bankruptcy alleged being the execution of a deed of assignment on June 7th last of the debtor's property to Mr. John R. Woodley, as trustee for the general benefit of the creditors. It was stated that the debtor had gone over to Germany, but was expected to return shortly, and, after some discussion, the meeting was adjourned for a fortnight to give the debtor an opportunity to attend under the proceedings.

Liquidation.—Benham & Froud, Ltd.—Voluntary liquidation was resolved upon on September 12th, with Mr. W. B. Peat, 3, Lothbury, E.C., as liquidator.

Metric Chart.—An explanatory chart of the metric system, well suited to explain clearly the value and simplicity of this system of weights and measures, has come to hand from the Decimal Association. The chart has been compiled by Mr. J. G. Pilter, of Paris, and bears the written approval of many eminent men, all signatures being reproduced in *fac-simile*, and thereby adding to its interest. The explanation of the various metric measures is very concise and simply written, and to those interested the chart should prove very useful. For the purpose, too, of instructing those attending schools, &c., it is admirably adapted. It can be obtained from the secretary of the Decimal Association, Salisbury House, E.C., at 1s. per copy, or mounted on linen, fitted with rollers and varnished, 5s. The chart measures 44 in. × 24 in.

LIGHTING AND POWER NOTES.

Cardiff.—We gather from a local report that both the Corporation and the South Wales Electrical Power Distribution Co. are to give terms to the proprietors of the Ely Paper Mills for a supply of energy. It appears that the works are partly in the Cardiff area and partly in the company's area. The company has protested against the Corporation supplying outside its area, and the Corporation will probably do the same in regard to the company endeavouring to supply that portion within the Council's area. However, the electrical engineer and the town clerk are considering the matter.

Chepstow.—A very neat, well printed, and attractive little booklet has been issued by the Chepstow E.L. and P. Co., which indicates the advantages to be derived, in so many ways, by the adoption of electrical energy for lighting, power and heating. Consumers and others at Chepstow should obtain a copy of this interesting booklet, which can be had upon application to the company.

Coventry.—At the meeting of the T.C. on Tuesday, a recommendation was made by the Gas Committee in favour of a reduction in the price of gas for motive power. This has arisen in consequence of the likelihood of suction gas plant being introduced in some of the factories, and it was pointed out that if the gas undertaking lost the custom of the large manufacturers, the price of gas to the ordinary consumer would have to be raised. The proposal met with vigorous opposition, and it was argued by Alderman West, Chairman of the Electricity Committee, that this Committee would be expected to reduce its charges for electricity for motive power. By a large majority the recommendation was referred back.

Dartford.—The past year's working of the U.D.C.'s electricity undertaking shows a deficit of £1,270, against a loss of £2,316 in the previous year.

East Ham.—The gross profit of the Corporation E.L. undertaking for the four years ending March 31st last amounted to £26,849, which has been allocated as follows:—Sinking fund, £9,180; interest, £12,771; depreciation and reserve, £2,358; initial expenses, £790. It has been resolved to put the balance, viz., £1,750, to the relief of rates. The capital expenditure to March 31st, 1905, was £417,286.

Electricity in Mines.—The Consett Iron Co. are about to provide their Chopwell and Garesfield Collieries with an electrical installation. Three-phase energy will be generated at the Chopwell Colliery at a pressure of 625 volts; part will be stepped up to a pressure of 3,000 volts, and transmitted 2½ miles to the Garesfield Colliery, where it will be again transformed to a working pressure of 625 volts.

Farsley.—The U.D.C. has been asked by the Yorkshire Electrical Power Distribution Co. to consent to the company's application for a prov. order for E.L. in the district; it would give a supply for lighting at 4d. per unit, and guarantee the cost of public lighting at not more than 2d. per unit. The Council has decided to ask the West Riding C.C. to consider the question of promoting a Bill whereby the public bodies in the area might jointly supply electricity.

Gas v. Electricity.—The Stourbridge Guardians have decided to light their new Workhouse with gas, on the assumption that it will be cheaper than electricity. The West Ham Educational Committee has, however, considered the merits of the rival illuminants for the lighting of the Hilda Road Schools, and has decided to adopt electric light, the price to be paid being 4d. per unit.

Glasgow.—The Electricity Committee of the T.C. is making arrangements for taking over the Pollokshaws E.L. Order, 1905.

India.—The Lahore Municipal Committee has decided on electric lighting for the Mall. Messrs. Jessop & Co., Ltd., Calcutta, have been selected by the Government to carry out the work. They have undertaken to complete the installation before the Royal visit.—*Indian Engineering.*

Ireland.—Arrangements are being made at the District Lunatic Asylum at Mullingar, Ireland, to charge ignition accumulators for motorists. The suggested charges are, however, somewhat high.

Italy.—A concession has been secured by La Società Illuminazione Elettrica di Cortemilia (Cuneo) to put down a plant to utilise the water power of the River Bormida in the generation of electrical energy for lighting purposes.

(*Continued on page 511.*)

THE OLYMPIA ELECTRICAL EXHIBITION.

The Exhibition which was opened on Monday last, by the Lord Mayor of London, can perhaps claim to be the largest of its kind ever held in this country. It is true that, in fulfilling its primary object—viz., that of influencing the user of electricity—want of space would effectually curtail any extended display of heavy plant. But we think it will be admitted that, in its own special sphere of impressing upon the general public the merits of electricity, the Exhibition lacks little, either in quantity or quality.

Altogether nearly 250 exhibitors are present, representing every branch of the trade, and their efforts towards attractively displaying materials which do not naturally lend themselves to this end have been so uniformly successful, that we may be excused the onerous task of drawing up such a lengthy roll of merit as this must needs be.

We can here give but a brief idea of the extended scope of the exhibits; but electric lighting can be studied in all its most recent forms, ranging from the powerful flame arc, and machine tools all find their places in and give added interest to the Olympia Exhibition.

A word may be said as to the arrangements for supplying energy to the stalls, &c.

The Hammersmith Borough Council will supply the bulk of the energy, in the form of single-phase alternating current at a pressure of 2,400 volts. Three direct feeders are provided, each terminating in a special sub-station, where the pressure is transformed down to 220 volts for the stall-holders.

In addition to this a direct current supply is available from high-speed generating plant installed in the Exhibition hall.

For the permanent lighting of the Exhibition 180 twin-carbon single enclosed arc lamps of Messrs. Veritys' make, and eight flame arcs of the "Excello" type have been provided. Flame arcs are also prominent outside the Exhibition, and in the front design, covering an area of some 3,200 sq. ft., more than 1,000 8-c.p. lamps have been used.

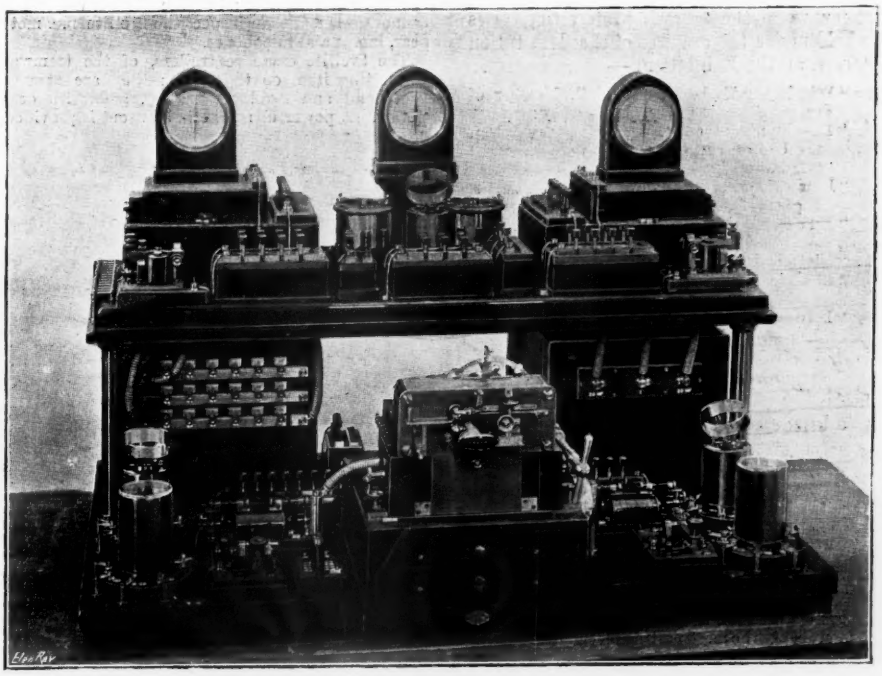

Fig. 1.—Postal Telegraph Department's Exhibit: High Speed Duplex Automatic Apparatus, with Repeater (Modern Section).

to the Nernst, tantalum, osmium and mercury vapour lamps.

Our old friend the carbon filament glow lamp, in process of manufacture at two prominent stalls, is sure to excite special interest. The choicest of artistic fittings are shown by many firms of repute, and the auxiliary departments of heating and cooking are by no means neglected.

Another equally important sphere of electrical development is that of telephonic and telegraphic work. The former is well cared for in the hands of the many prominent firms who are showing at Olympia; the latter is exemplified by the interesting loan exhibit of the Postal Telegraph Department, an exhibit which represents years of work, entailing both success and failure, and the Marconi stand, which may be said to represent the coming era of telegraphic work, will prove equally instructive.

Dynamos and motors, in the smaller sizes, and mostly of standard design, are to be seen in plenty, an added interest being obtained in many cases by working exhibits; in switchgear the engineer will find developments taking place, and much that will interest him.

Motor fittings and accessories, instruments of all kinds, the steam and gas engine and their adjuncts, lifts, winches,

As previously mentioned, the Exhibition was opened by the Lord Mayor, Sir John Pound, Bart., and subsequently an inaugural luncheon was held in the building, presided over by Mr. E. Cunliffe Owen, the chairman of the Executive Committee.

The toast list was a brief one, embracing "H.M. the King," "Success to the Exhibition," "The Electrical Industry," "The Lord Mayor" and "The Chairman."

In responding to the second toast, the chairman (Mr. E. Cunliffe Owen) jocularly referred to the absence of Sir William Preece, who had recently been located near the Equator. He pointed out the great advances that had been made in the practical and artistic design of all electrical apparatus within recent years, also the extended uses to which electricity is now put. Some 230 millions sterling had been invested in electrical concerns in this country, and one of the reasons of the exhibition was doubtless to obtain an improved return on some portion of that amount.

The exhibition had been organised by the electrical trade, and the exhibitors were the promoters; any profit resulting would be devoted, first, towards reducing the space rentals of the exhibitors; and secondly, towards the Electrical Trades Benevolent Fund.

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He concluded by thanking all those who had so ably assisted in the enterprise.

The toast of the "Electrical Industry," proposed by Sheriff Sir G. Vesey Strong, was responded to by Colonel R. E. B. Crompton, on behalf of the electrical manufacturers; the Mayor of Hammersmith, on behalf of the municipal electrical undertakings: and Mr. W. H. Patchell, for the electric supply companies.

The Colonel's opening remarks had reference to the 1878 electrical exhibition, where his exhibit was one arc lamp. The present exhibition was an answer to those who doubted the progress of electrical work in this country, and he considered that the exhibits were right up to the top.

The Mayor of Hammersmith, in replying, pointed out that the reduced rates of charging for energy adopted by his and other Borough Councils would prove of direct benefit to the wiring contractor and manufacturer.

Mr. W. H. Patchell, representing the supply companies, remarked that they had no security in the form of ratepayers to fall back on, and that they were entirely dependent on their excellent plant and the good feeling of the public for success. He thought there was no better way of educating the public than by such an Exhibition as this, which was primarily intended for the user.

During the next few weeks the following interesting series of lectures will be held under the auspices of the Institution of Electrical Engineers, at the Exhibition :—

Friday, Sept. 29.	"Wireless Telegraphy."	W. Duddell, Member of Council I.E.E.
Tuesday, Oct. 3.	"Development of the Use of Electric Motors."	Col. R. E. Crompton, C.B., Past-President I.E.E., M.Inst.C.E.
Friday, Oct. 6.	"Domestic Electric Lighting."	J. Swinburne, M.I.E.E.
Tuesday, Oct. 10.	"Electricity Meters."	S. Z. de Ferranti, M.I.E.E.
Wednesday, Oct. 11.	"Electric Heating."	H. J. Dowsing, M.I.E.E.
Friday, Oct. 13.	"Electric Telegraphs."	A. Martin, Postal Telegraphs, Cambridge.
Tuesday, Oct. 17.	"Electric Arc Lighting."	Mrs. Ayrton, M.I.E.E.
Wednesday, Oct. 18.	"Electric Traction."	W. M. Mordey, M.I.E.E.
Friday, Oct. 20.	"Telephones."	F. Gill, M.I.E.E.

Some of the succeeding pages in this and in later issues will be devoted to a brief account of the various exhibits.

The Postal Telegraph Exhibit.

No introduction is needed to the telegraphic exhibit of the Postal Telegraph Department of the G.P.O., as it is of a similar character to that which gained the grand prize at the St. Louis Exhibition.

In the modern section a duplex automatic apparatus, with a fast speed repeater, is shown in working order (fig. 1, p. 503). This apparatus illustrates the system used for the transmission of Press and special work, which is probably the most perfect mechanical method of transmitting news by the Morse code yet invented. It is interesting to note that duplex telegraphy was first solved in 1853 by Dr. Gintl. Automatic telegraphy was introduced by Prof. Wheatstone in 1859. The Morse code was employed by making the upper line of perforations represent the dots, and the lower line the dashes.

Messages are first dealt with by perforating holes in a strip of paper, which is passed through the transmitter by means of trainwork, where the perforations permit currents, separated by intervals of long or short duration, to be sent to the distant station.

Two complete sets of quadruplex apparatus are shown in working order. This arrangement permits of four messages—two each way—being sent over one wire at the same time. This method of working was first attempted by Stark, of Vienna, and Bosscha, of Leyden, in 1855, but it was not until 1874 that Edison succeeded in making quadruplex working practicable.

The principle of working is based upon the fact that currents of electricity differ from each other only in their strength and in their direction. This is accomplished by combining double current and single current working in such a way that one relay is worked by the one system, and the other relay by the other system. A current is constantly flowing through the line; a change in its direction operates one relay, an increase in its strength operates the other relay. The first relay is a simple polarised one, differentially wound, the rigid tongue of which responds to the reversal of the current, whatever its strength; the second relay may be polarised or non-polarised, and is adjusted, by means of antagonistic springs, so as to fail to respond to the current, the direction of which is changed, unless the current be considerably strengthened. Thus the two relays are perfectly independent of each other. They actuate separate sounders, and each is under the control of its own receiving operator.

A single current sounder is exhibited; this consists of an electro-magnet, with an armature attached to one end of a lever, at the other end of which is attached an antagonistic spring, and was introduced in 1853. It is a non-recording modification of the Morse embosser. The set of apparatus exhibited is modern and in general use.

A modification of the bottle inker, patented in 1862 by Siemens, and used in recording instruments, is also on view.

The historical section is very complete, and includes many of the earlier needle instruments; a Thomson electrometer; specimens of old submarine and lead-covered cables; a specimen of old pneumatic tube with carrier, laid 1854, recovered 1870; Hughes electrically driven type-printing telegraph; insulator specimens of historic interest; a Morse embosser, which was used about 1853 by the Electric Telegraph Co. This supplanted Bain's chemical recorder, as it obviated the troublesome chemical preparation of the paper, but reading the embossed marks was found so fatiguing that this instrument was in turn displaced by the sounders and ink-writer (bottle).

A relay or local circuit is used to work the electro-magnet, the armature of which is fitted to a horizontal lever, working between stops at one end and carrying a steel style at the other. When the armature is attracted downwards, the style is pressed upwards against a strip of paper drawn from a large reel by two friction rollers set in motion by a train of clockwork. In the upper roller is a narrow groove into which the style presses the paper and, according to the time the armature is held down, embosses a dot or dash.

The Electric and Ordnance Accessories Co., Ltd.

The Electric and Ordnance Accessories Co., Ltd., of Stellite Works, Birmingham, exhibit a large selection of their well-known specialities, all produced in their Birmingham works. It would require more space than we have at our disposal to run through all that is to be seen here; but the visitor, with time on his hands, cannot do better than inspect the Stellite d.c. motors, fans, switchgear, lamps and telephones.

The Stellite crane controllers, of the tramway type, form an interesting item on the stand; they are arranged for reversing, compound and 2-voltage control, and with or without braking points. A powerful magnetic blow-out is provided, and the weight

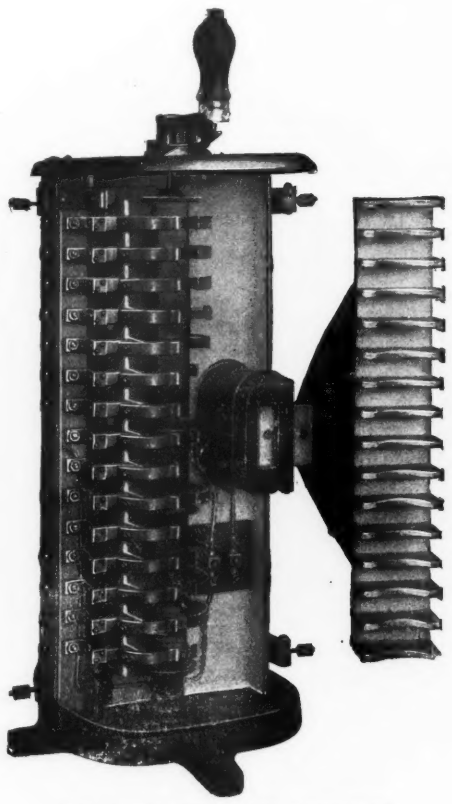


Fig. 2.—Stellite Crane Controller.

of the drum is taken by a ball thrust bearing, while access to the several parts is an easy matter. Stellite circuit breakers of many designs are on view; a new, simple and cheap design being prominent.

For want of space we pass over numerous motor starters and the Stewart enclosed arc lamp exhibits, and come to a telephone switchboard on the Stellite central battery exchange system, which is shown in operation. This system has recently been installed in Osborne House, Somerset House, the University College, and numerous large works in this country, and it is meeting with increasing favour.

The Stellite S.D. telephones for reply and call are also shown in operation; they are primarily intended for domestic use on existing bell systems. Numerous other telephonic and electrical devices complete an excellent display, which, it is worthy of note, is all produced from the hand of the British worker.

Messrs. Ferranti, Ltd.

Messrs. Ferranti, Ltd., provide an exhibit which will appeal strongly to station engineers; few of the latter at the present day need an introduction to the company's well-known slate cellular form of switchboard, but in its modified and improved form, as shown on the stand, it differs materially from the older designs.

The exhibit which most nearly resembles the old type of Ferranti cellular gear is a sample generator panel with bus-bar extension, which is a duplicate of one of some 48 more or less similar panels recently supplied to the order of the Sydney Corporation, but in this it will be noticed that the old oil porcelain fuses have been replaced by an automatic circuit breaker, which is entirely separated from the switchboard attendant by a substantial enamelled slate front. The switch is of the well-known tank type, each phase being in a separate tank, and the breaks are entirely under oil.

Another example of a cellular board consists of a typical generator, feeder and summation panel. All bus-bars, current and potential transformers, isolating switches and circuit-breakers are enclosed in separate concrete cells.

The switches are of the remote control type, arranged for operation from a bench control board erected overhead on an upper gallery, and a small portion of a gallery has been installed along one end of the stand.

A less expensive type of high-tension gear for controlling smaller

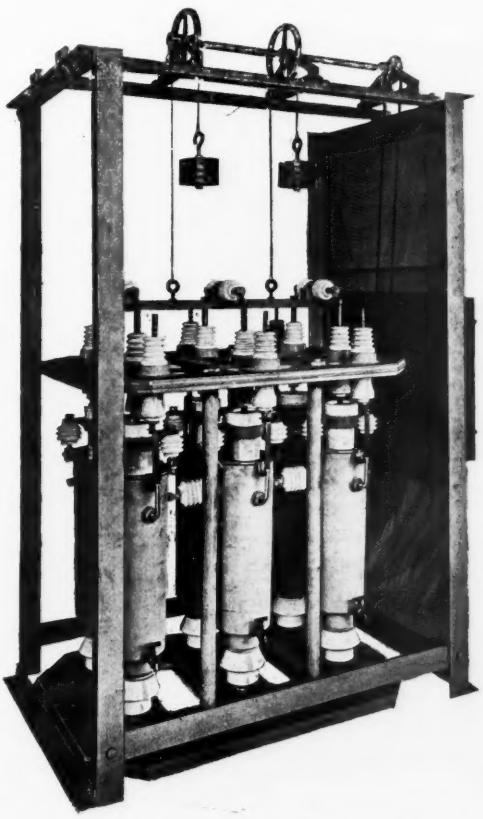


Fig. 3.—H.T. Feeder Charging Gear.

powers, and where a gallery is not available, is illustrated in a section of a semi-ironclad switchboard.

The continuous current boards represent sample panels for traction, lighting and power work; while isolated high and low tension motor panels may also be inspected.

Among the newer apparatus is a direct current circuit-breaker on the carbon break principle. The carbon on the movable arm is arranged to swivel so as to give the best possible contact with its partner, this being attached to a sliding sleeve pressed outwards by a strong spring. This spring serves the double purpose of providing a quick break, acting as it does at the maximum radius on the movable arm, and it also ensures that the carbon supported by the fixed portion of the circuit breaker, follows the other sufficiently far during the opening motion, to ensure that the final break occurs between the carbons and not between the main contacts. The breaker is closed by a very simple toggle-joint arrangement, and no solenoid is required for the overload tripping mechanism. These circuit breakers are made for both overload and reverse current. The firm's new type of feeder charging gear suitable for three-phase circuits up to 10,000 volts is shown in fig. 3. It consists of six cast-iron circular tanks supported on heavy porcelain insulators; inside each tank, and concentric with it, a porcelain pipe is fixed. Insulated copper rods linked together are gradually lowered by suitable mechanism into the tanks, which contain water, and in the bottom a small cast-iron pan of mercury. The cast-iron tanks themselves form the terminals of the different phases, so that no flexible connections are required.

N. Burt & Co., Ltd.

The stall of Messrs. N. Burt & Co., Ltd., of 195, Wardour Street, W., will be appreciated by all whose interest lies in really

Fig. 4.—Bronze Figure, Fitted for Electric Light.

artistic fittings. Many of the wall brackets, lustres, candelabra, lanterns, table lamps, &c., shown in such profusion by this firm, are

Fig. 5.—Example of Candelabra.

reproductions of English, French and Italian models of the 17th and 18th centuries, and are of exceptional beauty. Fine examples

of Renaissance, Queen Anne, Elizabethan and Georgian fittings are on view, the Huntalite candle lending itself admirably as a substitute for its earlier prototype. The firm also specialises in bronze and composition statuary adapted to the needs of electric lighting, and many fine specimens of this class of work are shown.

Vickers, Sons & Maxim, Ltd.

Messrs. Vickers, Sons & Maxim's exhibit will be hailed with delight by all those who suffer from the idiosyncracies of planing or other reciprocating machines driven by antiquated methods. Several arrangements for getting over the only too apparent deficiencies of the old belt drive have been tried, but the results obtained with this firm's patent automatic reversing gear used in conjunction with an electrical drive, and shown attached to a planing machine, place it in the front rank.

Briefly, the equipment consists of a variable speed shunt wound motor with a speed range of 3 or 4 to 1, and a group of special switches suitably mounted on the machine, and worked from the driving gear. The functions of these switches are (*a*) to start the motor after it has come to rest at the end of the stroke; (*b*) to insert or withdraw resistance in series with the field coils, thus altering the speed after reversal; (*c*) to reverse the armature connections, and thus reverse the direction of rotation; (*d*) to retard the armature at the end of the stroke by strengthening its field prior to reversal.

The operation in its simplest form may be described thus:—The planer is driven by a motor with a range of speed from about 300 to 900, through spur or worm gearing. On the cutting stroke the motor runs at its slowest speed, and at the end of the stroke it reverses automatically. As soon as the reversal has occurred, a resistance is automatically inserted in the field winding, quickly raising the speed to 900 for the return stroke. At the end of the quick return stroke, immediately before reversal, the field resistance is short circuited, providing a strong field for reversing in, and the motor reverses, the cycle repeating itself. In order to start up or stop the planer, it is only necessary for the operator to throw over a simple switch.

The speed of the motor is varied entirely by shunt regulation, and its efficiency under any circumstances is not less than 87 per cent. But the feature of the arrangement is the fact that the cutting speed can be varied instantly (by the movement of a switch handle) from its slowest limit up to that of the quick return, thus enabling the greatest output to be obtained from the machine. The elimination of the belting, which on planing machinery is subjected to very rough usage, and the substitution of a positive and quick action, such as that described, also means no inconsiderable economy of time and temper. The arrangement has been used by the firm for some time and has given every satisfaction.

In addition to the above, a variety of D.C. and A.C. motors and an electric winch are on view at the stand.

Schiff & Co.

Messrs. H. G. Mayer & Co., agents of the above, of 67, Aldersgate Street, E.C., provide for the wants of the engineer in the way of carbon accessories, cables, flex, &c.

Crossley Bros., Ltd.

The name of Crossley is almost a household one, and certainly a world-wide one where the gas engine is concerned. Messrs. Crossley's exhibit of high-speed gas and oil engines, specially adapted for electric lighting purposes, and shown in operation driving dynamos, well maintains their high reputation as engine builders. The engines are of various sizes ($27\frac{1}{2}$ to $4\frac{1}{2}$ B.H.P.), and work in conjunction with modern suction gas plants, which in themselves are items of no small interest at the present day.

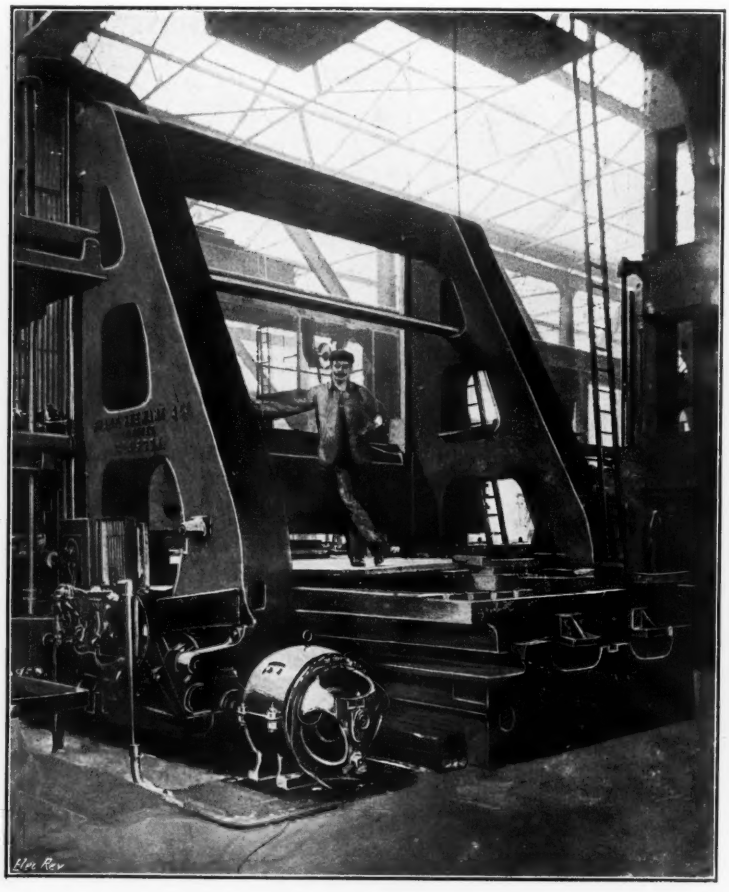


Fig. 6.—Planing Machine Fitted with Electrical Driving and Automatic Reversing Gear.

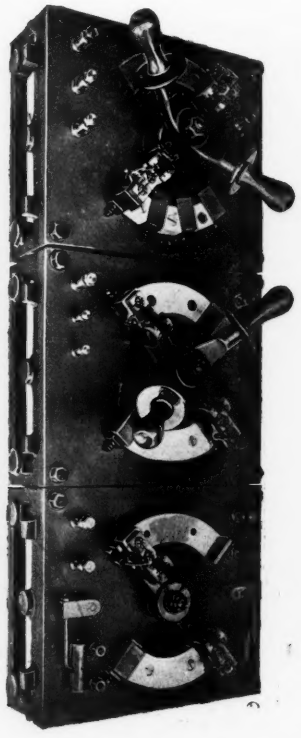


Fig. 7.—Controlling Switches for Electrically-Driven Planing Machines.

J. E. Spagnoletti & Co.

Messrs. Spagnoletti & Co. exhibit various apparatus, including switchboards for lighting and power, crane control boards, motor starters, street panels for power and lighting, and small switchboards in great variety. The crane control boards are mounted in water-tight iron cases of neat design, and comprise double-pole switch and automatic circuit-breakers, which are closed by levers from the outside. The motor starters are also in water-tight and dust-proof cases, and are operated from the outside; a push button, which is provided for switching the motor "off" when desired, forms a very useful addition, as the case need never be opened when starting or stopping a motor.

Visitors will be attracted by a working model of the patent Stigler lift, the chief features of which are the easy and safe method of control, the car stopping automatically at any desired floor by simply pressing a button.

A good specimen of their well-known switchgear is shown in a board built for a 3-wire lighting supply; several types of telegraph and railway signal instruments, an automatic tramway signal for use on a single line, which is operated by the trolley head passing spring contacts as it either enters or leaves the section, and other novelties add to the interest of this stand.

The Temperley Transporter Co.

The Temperley transporter has proved its great value at many central stations. It is an ingenious apparatus which, to be properly appreciated, must be seen at work. As Olympian facilities do not include full-sized coal bunkers, the company has arranged to impress the visitor by means of excellent working models of the apparatus. These include the Temperley patent traveller; a Temperley portable transporter rigged on a vessel's derrick; a travelling tower transporter with a patent automatic dumping skip discharging coal from ship to shore, &c.

In addition to these models, which represent the Temperley transporter in the more generally known forms, an entirely new working model on a large scale is shown of the latest type of transporter working with a grab. This model discharges coal from the

Fig. 8.—Temperley Transporter, showing Operating Tower; West Ham Elect. Works.

Fig. 9.—View showing Transporter over Coal Bunkers; West Ham Electricity Works.

hold of a lighter, direct into the storage hoppers over the boilers at a central station. The operating winches are driven by electric motors; the operations of lifting, lowering, opening and closing the grab are performed by means of a double drum winch, and the traveller is traversed along the transporter beam by a separate winch. The hoisting winch is fitted with special compensating gear, enabling the operations of hoisting or lowering and transporting to be carried on singly or simultaneously, without one motion interfering with the other. This secures considerable saving of time, as the horizontal transporting motion can be commenced as soon as the load is lifted high enough to clear the coamings of the vessel's hatchways, and before it is lifted to its full height, and the load or grab can be again lowered to the level at which it is to be discharged before the transporting movement is completed.

The levers controlling both the hoisting and transporting winches are assembled at the operator's platform, and the whole of the movements are controlled by one man.

These grabs can be made of a lifting capacity of from 12 cwt. to 5 tons or more, and according to the power of the motors and winches, duties can be obtained of from 20 tons to upwards of 200 tons per hour with one transporter.

J. C. Fuller & Son.

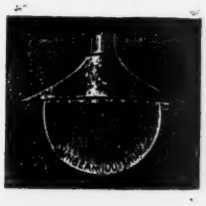
The most interesting item at Messrs. John C. Fuller & Son's stand is probably the Fuller mercury bichromate battery; although the latter has a reputation of 50 years behind it, its continued application in many directions, and notably in connection with telephone and telegraphic work, indicates sterling qualities, which cannot be ignored. Within recent years a modified type of the cell has been largely employed by motorists for accumulator charging, specimens being shown on the stand.

The firm is also exhibiting an assortment of electrical items of special interest to the motorist, including electric lamps fitted with osmium filaments.

Among other items of interest we noted the new Langdon and Fuller high-tension insulator, which has been tested up to 60,000 volts, and for which the undeveloped field of high-tension transmission work in this country offers a golden opportunity.

The Sunbeam Lamp Co., Ltd.

The Sunbeam Lamp Co., Ltd., of Gateshead-on-Tyne, are to the fore with a working exhibit of their well-known "Sunbeam" lamps, in which "Sunbeams" of all shapes and sizes, including a veritable giant of some 3,000 c.p., greet the eye. A new type of reducing lamp, introduced to meet the public taste for "turning down the light," is a novelty worth inspection, and the numerous switches, radiators, fans, pendant fittings, &c., shown at the stand form an interesting and up-to-date show.



Figs. 10 & 11.—Sunbeam "Outshine" and Radiator Lamps.

Escaré & Denelle, Ltd.

Messrs. Escaré & Denelle, Ltd., of 129, Wardour Street, W., are showing a fine selection of electroliers, brackets and art fittings generally.

Elliott Bros.

Of Messrs. Elliott Bros.' specialities, it may be said that few engineers can afford to be without them. The exhibition series includes a new line of indicating instruments, shown in actual operation on a switchboard; these are of the moving-coil dead-beat

type, and a zero device is fitted for enabling any slight error to be corrected at once.

The recording instrument described in our issue of September 8th is also shown in operation, and we gather that a new form of

Fig. 12.—Century Mains Testing Set.

recorder, in which fresh rolls of paper can be fitted without opening the instrument, will shortly make its appearance.

The Century mains testing set, which has been designed with a view to providing an instrument that will cover the whole range of testing which ill luck may place in the path of the average mains engineer, is also on view; we illustrate it in fig. 12; it only needs inspection for its good qualities to be appreciated.

The "Groves" patent network ohmmeter (previously described in the Electrical Review) and numerous other switchboard, portable and laboratory instruments, are also worth study.

Albert C. Hands.

Mr. Albert C. Hands, of 30, Snow Hill, E.C., has an extensive exhibit of fittings, including electroliers, rise and fall

Figs. 13 and 14.—Hands' Electroliers.

pendants, lanterns, brackets and standards. The fittings, of which we illustrate specimens, will appeal to the artistic tastes of visitors and possible purchasers, as also will the special line of radiators shown by this firm.

The Tudor Accumulator Co., Ltd.

The Tudor Accumulator Co., Ltd., of 119, Victoria Street, S.W., show on their stand a large number of the various standard types of stationary cell made by them, in glass, lead-lined wood and lead boxes, and ranging in capacity from 50 to 7,500 ampere-hours; the latter is one of the largest type of cell in use in this country. In two of the largest cells the sides are removed, and the details of the internal arrangement can be clearly seen. Samples of the plates, both formed and unformed, as well as sections showing the structure of the positive plates, are on view, together with the recently-designed negative plate, from which a much longer life is anticipated than in previous types.

There is also to be seen on this stand an automatic regulating switch of the Trumpy pattern, for which the Tudor Accumulator Co., Ltd., are sole agents in this country; this switch is an ingenious piece of mechanism, and can be used not only for keeping the voltage constant, but also as a means of working a regulating switch at a distance.

The Pearson Automatic Fire Alarm, Ltd.

The Pearson Automatic Fire Alarm, Ltd, of 62, King William Street, E.C., exhibit specimens of their latest fire alarm fittings. The protection afforded by many automatic fire alarms in breweries, laundries, soap works, &c., and similar business premises in which escaping steam, acids or excessive moisture are present, has been somewhat unreliable, and the Pearson Co.'s new instrument is intended to meet such cases. In form it is an oblong box approximately 5 in. × 2 in. × 1½ in. This carries upon the underside, attached rigidly to it, a thermal strip, in the centre of

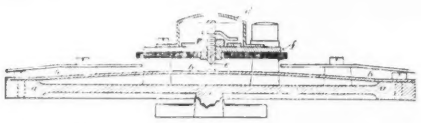


Fig. 15.—Diagram showing Construction of Fire Alarm Fitting.

which is fixed a metal pin having an insulated tip. The pin passes into the box through a gland which prevents the entrance of moisture. The internal apparatus consists of two contacts built upon an insulated base and connected to a terminal at each end. One contact is adjustable as to temperature; the other contact is built upon a flexible hard-drawn phosphor-bronze spring and rests upon the insulated pin of the thermal strip. Any deflection of the latter by means of heat at once affects the position of the flexible contact, and when the temperature limit of the instrument is reached, contact is made and an alarm given. The connecting wires are led to the terminals through stuffing boxes, and to facilitate inspection, a cover is provided which is seated upon a thermal packing held rigidly in place by metal screws. It will readily be

Fig. 16.—Exterior of Fire Alarm Fitting.

seen that movement of the contacts can only be effected by the action of heat, and as the terminal wires are enclosed, no imperfect insulation can occur owing to the presence of moisture, acids, &c.

Babcock & Wilcox, Ltd.

The name of Babcock & Wilcox is almost synonymous with water-tube boilers, for which they have a world-wide connection; they are, however, equally to the fore with boiler-house accessories, and on their stand may be seen conveying plant, water softening and purifying plant, the firm's well known chain-grate stoker, the turbine tube cleaner and sundry steam piping. One of their latest marine type boilers, fitted with feed-water heater and chain-grate, which is being utilised for supplying steam for exhibition purposes, is open for inspection.

Electromotors, Ltd.

Electromotors, Ltd., the well-known Openshaw firm, show a very complete range of their speciality: motors. The exhibits are all of up-to-date design, and embrace the newest types, the sizes

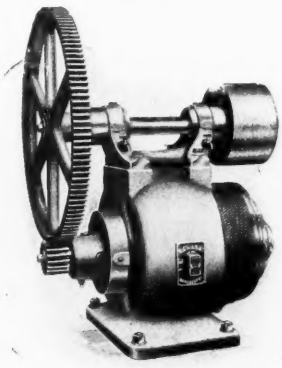


Fig. 17.—Standard Motor and Spur Reduction Gear.

ranging from ¼ to 25 b.h.p. These motors are fitted with the novel form of brush holder described in our last week's issue, and can be seen in operation, controlled automatically from a solenoid switchboard of Sturtevant type.

Among other items we may specially mention and illustrate the

Fig. 18.—Electrically-driven Propeller Fan.

firm's new propeller fans; the standard spur reduction gear motor (also illustrated); an electrically-driven knife cleaner with a capacity of 1,000 knives per hour, and other machinery. The firm's productions are all to standard size and gauge, matters which are fully appreciated at the present day.

Longstreth's, Ltd.

Part of Bay 4 is occupied by Messrs. Longstreth's, Ltd., more usually known under the name of their manufacture, "Lithanode." This company's manufacture is a distinct departure from the ordinary type of secondary batteries, and claims certain special advantages. In the Lithanode cell the peroxide of lead is obtained in a solid cake or pellet sufficiently firm and hard to require no inner support at all. These pellets, which usually have a surface of about 2¼ sq. in., are placed in position in a mould, and have a frame of molten lead run round their edges, the lead, as it cools, shrinking on to the pellets and making a peculiarly tight and conducting joint. In this way, plates of any size can be built up, and the exhibit shows the various sizes of cells manufactured by the company, ranging from the smallest size of test cell with a capacity of ½ ampere-hour to the central station lighting set. The Lithanode cells for motor ignition are too well known to require a lengthy reference. The unspillable cells in particular have proved a great boon to motorists. The company is also exhibiting a traction cell of about 150-ampere-hour capacity—a useful size suitable for many purposes, such as yacht lighting, motor traction, motor-boats, &c. These cells have a slightly greater weight than the very light cells now on the market for traction purposes, but as they are more strongly built, the possibility of long life and freedom from the worry and annoyance of renewals will be compensating advantages. The lighting cells exhibited are of the firm's usual make; they are light cells for the capacity contained, and, in common with all Lithanode plates, will stand exceptionally high rates of charge and discharge without injury. These cells have been known to run for 9 or 10 years, and to be in good working order at the end of that time, which fact speaks for itself. Many other types of cell are shown by the firm, and the stand is well worth a visit, if only to see a form of plate which is not as other plates, and which is holding its own well among the various cells of the present day.

The Steel Core Concrete Co., Ltd.

The Steel Core Concrete Co., Ltd., of Suffolk House, E.C., make a speciality of their "S.C.C." conduits and troughing, which,

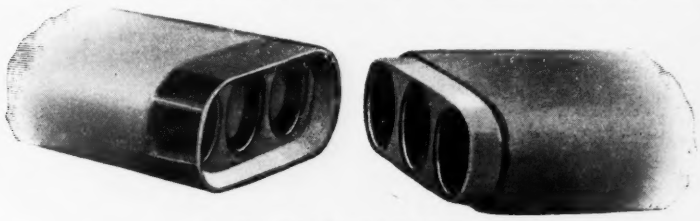


Fig. 19.—The "S.C.C." Conduit.

as the name implies, consist of cement mortar moulded on to a skeleton of expanded steel, an arrangement giving both strength and cohesion, combined with light weight.

The General Electric Co., Ltd.

The stands of the General Electric Co., Ltd., occupy a prominent position in the main avenue, and though their contents are sufficiently numerous and varied in character to form an independent

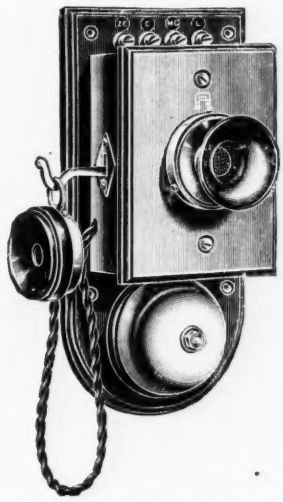


Fig. 20.—Wall Telephone Set.

exhibition, they yet represent but a fraction of the items turned out by the company.

The exhibit is divided into sections, each representative of a

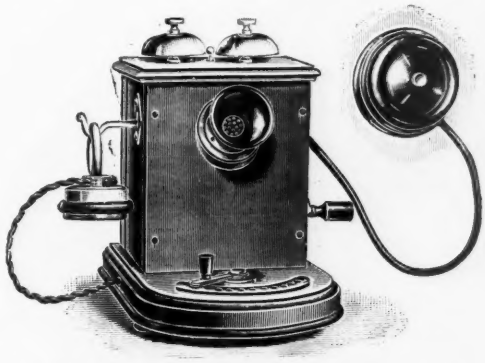


Fig. 21.—Intercommunication Table Telephone.

special department; prominent among them is the telephone section, where instruments adapted for practically every conceivable purpose are on view. These include traction telephones, standard

pattern wall and table magneto telephones, battery call table and wall telephones for short line working, direct working battery telephones of every description, magneto and battery intercommunication telephones, automatic self-replacing (S.R.) intercommunication sets, fire alarm indicator contacts and telephones, annunciator switchboards, &c.

A feature of the exhibit is the company's telephone K 25, to which many improvements have recently been added. This little

Fig. 22.—G.E.C. Radiator.

instrument has been proved to be perfectly efficient and reliable. We illustrate it in fig. 20.

Another new set which we illustrate in fig. 21 has only recently been placed upon the market—viz., the K 265 magneto intercommunication table set. This is made in various sizes, from five to 20 lines, and comprises "Byng-Hunnings" transmitter, double-pole ring receiver, and double magnet generator.

The Wire Department is showing wires and cables of all sorts, and the Fixtures Department is also adequately represented.

In addition to numerous artistic fittings, the M.I.P. (*multum in parvo*) window lighting system is shown. This is an arrangement of units in 12 in. lengths, which greatly facilitates the effective lighting of shop windows.

The Bell Department will no doubt be appreciated by the burglar fraternity among others, but it will occupy more than the exhibition month for it to become acquainted with the various devices, alarm bells, &c., for its undoing, here shown.

The display of the Engineering Supplies Department includes the well-known Freezor fans for D.C. and A.C. in all shapes and sizes, small D.C. motors, motor starters, transformers, liquid resistances, theatre lighting accessories, traction supplies, &c.

Electric heating and cooking apparatus and radiators are also on view, and among them we observed the "Apollo" and "Dolphin" radiators, now so well known and appreciated. We illustrate a new design constructed in fire-proof mahogany, walnut or other wood, and fitted with hammered copper reflector.

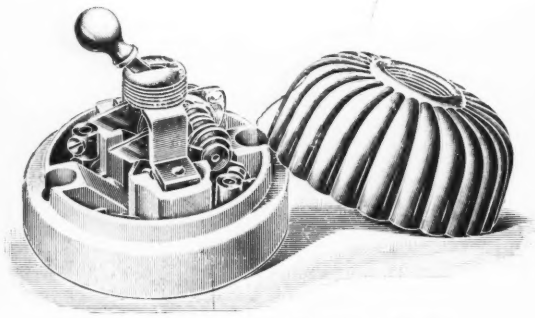


Fig. 23.—Two-way H.V. Quadrant Switch.

The company's heavier plant is represented by a number of "Witton" motors, D.C. and three-phase.

The conduit department finds space for a representative collection of its various specialities, amongst which may be particularly mentioned Union "papristeel" insulated conduits, in which the tubing is drawn on to the insulating lining instead of the insulation being expanded into the tube. This arrangement guarantees the lining always being held securely, and so overcomes the possibility of drawing the lining from the tube during the process of installing the wires.

For fixing conduit and the like to walls, &c., the "Union" improved patent plug is the very latest development in the "ready-made" plug idea.

A new adaptation of the company's 25-ampere "Midget" wall plug to conduit purposes is shown in the iron-cased watertight multiple way box with water-tight lid, and from among numerous examples of tumbler switches, we illustrate the company's new two-way H.V. quadrant switch.

The switch department defies adequate description here; it illustrates the latest in switches and instruments adapted for the thousand and one situations which obtain between the cottage and the central station.

The arc lamp department brings into prominence the new Angold flame arc lamp; also the company's standard Angold enclosed lamp, together with the numerous accessories requisite in this class of work.

The Standard Metal Engraving Co.

The Standard Metal Engraving Co., of Chancery Lane, W.C., have on view a fine collection of attractive metal and composition name-plates and designs, the uses of which are obvious.

The Hart Accumulator Co., Ltd

The display of the Hart Accumulator Co., of Marshgate Lane, Stratford, will well repay a close inspection; the firm specialises in storage battery work, and its standard productions range from the central station battery to the humble ignition cell. Thus a com-

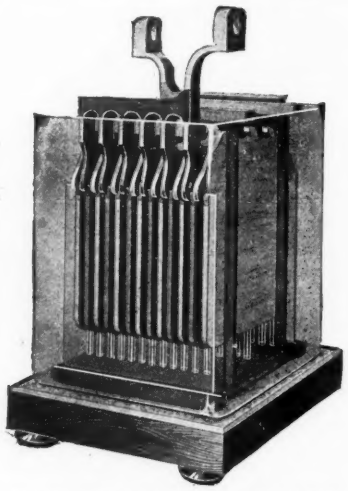


Fig. 24.—Single Lighting Type Cell.

plete 60-cell battery, suitable for a private installation, is on view, its capacity being 350 ampere-hours at 110 volts. The plates are suspended from glass slabs in glass boxes; they are separated by flanged glass tubes, and ample space is provided for the accumulation of deposit. The cells are connected together by means of the Hart patent non-corrosive terminals, which are an improvement in many

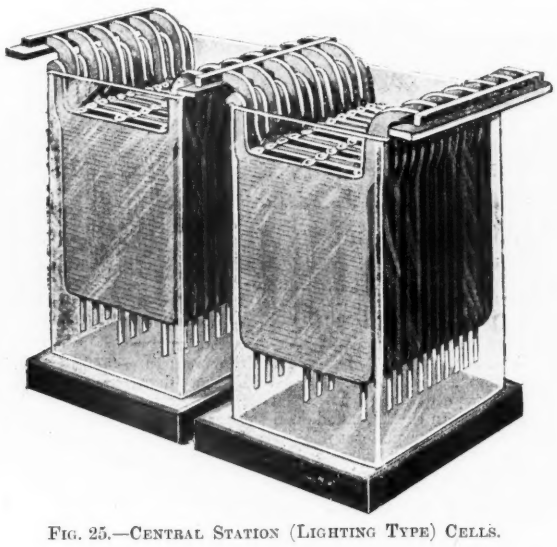


Fig. 25.—Central Station (Lighting Type) Cells.

ways over the lead burnt joint, being easy of disconnection and of low ohmic resistance.

Three types of central station cell are on view, the plates being supported and separated as above; 6 in. is allowed in the bottom of these cells for the accumulation of deposit, thus obviating the necessity of frequent cleaning. Automobile cells, yacht-lighting cells, ignition, telephone and telegraph cells complete a very interesting exhibit.

(To be continued.)

LIGHTING AND POWER NOTES.

(*Concluded from page 502.*)

Kingston-on-Thames.—The London papers announced last week that a leakage from one of the underground electric cables of the Corporation occurred, and that persons standing or walking near the spot received a shock.

London.—Hammersmith.—The B.C. last week considered the question of reducing the price of energy for power purposes. The present price is 1½d. per unit, with discounts ranging from 5 per cent. for accounts of £250 per annum, to 33⅓ per cent. on accounts of £1,500 per annum. The electrical engineer reported that a uniform rate of charge with discounts would meet the circumstances in a more satisfactory manner than any system of maximum demand with restrictions as to the period of use. It was resolved that at the end of the Michaelmas quarter a uniform rate of 1½d. per unit be charged for electricity supplied for power purposes, subject to the following discounts:—On accounts between £10 and £25 per annum, 10 per cent.; between £25 and £50, 20 per cent.; between £50 and £100, 30 per cent. In the case of a consumer whose account for power amounts to over £100 per annum, special arrangements will be made, if so desired by the consumer, to supply energy for both power and lighting purposes at the rate of 1½d. per unit, less 33⅓ per cent. discount, provided that the amount of energy used for lighting does not exceed 20 per cent. of the total consumption per annum, and subject to the consumer entering into an agreement to drive the whole of his machinery by means of power supplied by the Council for a period of no less than five years. The L.C.C. has requested the B.C. to lay its mains at a depth of at least 3 ft. 6 in. below the surface of the roadway, and to lay them in or as near the pathway as possible, in view of the possibility of the L.C.C. constructing tramways in the district.

Marylebone.—Referring to our note last week regarding the breakdown in supply, when a Queen's Hall concert had to be postponed, we learn that the failure was not on the Borough Council's system.

Battersea.—The B.C. Housing Committee, with a view to encouraging the tenants on the Latchmere and Town Hall estates to use the electric light, has arranged for a new 8-c.p. or 16-c.p. lamp to be presented to tenants for every 60 units consumed. The Lighting Committee has decided in favour of asking the L.C.C. to convene a conference of local authorities and such other bodies as it may think fit, for the purpose of considering the question of the erection of large generating stations and the supply of electricity in bulk.

Hackney.—Application is to be made to the L.C.C. to sanction a loan of £5,008 for electric lighting purposes.

Luton.—The gross profit of the Electricity Department for the year ended March 31st last was £2,046. The working costs amounted to £1,609. The income was:—Lighting and power, £3,297; public lighting, &c., £358. The net revenue account shows a credit balance of £11. The total units sold amounted to 274,521, and the maximum demand recorded was 284 kw.

Maidstone.—The T.C. has reduced the price of energy for shops and dwelling houses combined, to 4½d. per unit, with a rebate of 10 per cent. if over 10,000 units are consumed per annum.

During the past year a net profit of £466 has been made by the electricity undertaking, as against a deficit of £1,275 in the previous year.

Melton Mowbray.—A short while ago the Midland Railway Co. installed two 7½-h.p. electric motors at its pumping station. We learn that these have proved very satisfactory, and that it is now intended to put down three more motors for driving the company's saw mills, mortar pans and forge bellows, making a total of 41-h.p. of motors installed at the station. Energy is supplied from the Melton Mowbray E.L. Co.'s mains.

Mytholmroyd.—The U.D.C. has applied to the B. of T. for a year's extension of the E.L. order.

Rawtenstall.—A L.G.B. inquiry was held on September 21st, relative to the application of the T.C. for a loan of £12,000 for E.L. supply purposes, the Corporation having agreed to take energy in bulk for five years from the Lancashire Electric Power Co.

South Africa.—Johannesburg.—The T.C. announces that it is expected that energy will be available in Jeppestown, Fordsburg, Bertramstown, Hospital Hill, Yeoville, and other suburbs towards the end of the year, and that it is desirous of commencing the work of connecting prospective consumers' premises with the mains forthwith. The Tramway and Lighting Committee recommended the following appointments, which have been adopted by the T.C.:—A general manager to take charge of the entire tramway, lighting and power undertakings, for the initial period of the tramway and lighting scheme at a salary of £1,750 a year; an engineer in charge of the distribution system at a salary of £1,000 a year and a house; an engineer in charge of the generating station at a salary of £1,000 a year and a house; a tramway traffic manager at a salary of £1,000 a year. Also that applications be invited locally for the post of tramway traffic manager without delay.

Boksburg.—The T.C. Works Committee reported that the consulting electrical engineer stated that in view of the heavy Saturday night loads, the Council would be justified in allowing the Lighting Co. to make an extension to its plant, and it was decided that the company be informed that its request be allowed for an additional 80 kw. set.

King William's Town.—The T.C., in view of the gratifying results attending the five months' working of the E.L. undertaking, has decided henceforth to charge only 1s. per unit for energy for lighting purposes, instead of 1s. 3d.

Tottenham.—The North Metropolitan Electric Power Supply Co. has informed the Committee carrying out the arrangements with respect to the new municipal buildings, that it cannot say when the supply of electricity will be available from the company's mains. The company offers, however, to loan to the Council a small 6 kw. set, which would supply the Council chamber and committee rooms. This offer was accepted.

Tunbridge Wells.—A resolution stating that it is desirable in the interests of the ratepayers to consider the advisability of selling the E.L. undertaking upon terms that shall fully safeguard the nature and price of supply, and obviate further capital expenditure by the Council, and the risks and possible disadvantages attendant upon the control of the business by the municipality, is to be submitted to the next meeting of the T.C.

Tynemouth.—The accounts of the electricity department for the year ended March 25th last, shows that the capital expenditure during the year was £9,170, bringing the total to £79,451. The gross revenue was £10,788, and after meeting interest and sinking fund charges there was a small profit of £7. We gather that but for an accident to one of the boilers, which necessitated a somewhat heavy outlay, the margin of profit would have been larger.

Whitby.—Through the initiative of Mr. L. H. King, the Council's electrical engineer, an electrical exhibition is to be opened in the town to-day, and will be held until the 7th prox.

Worksop.—The U.D.C. has received sanction to raise a loan of £3,000 for E.L. purposes.

TRAMWAY AND RAILWAY NOTES.

Austria.—An official understanding has been arrived at whereby the Vienna Local Railway Co., as the undertaker for the high-speed electric traffic between the Opern Ring and Baden, will be authorised to use a speed of 27·9 miles an hour on this line, which is to be opened in March of next year. The reconstruction of the power station at Baden for single-phase alternating current is in progress. Every quarter of an hour a direct train composed of two coaches will leave the Vienna terminus for Matzleinsdorf, where a third coach with passengers from other districts will be coupled up, and the journey will then be continued to Baden, the trip being accomplished in 1 hour 8 minutes. It is expected that the electric main line between Vienna and Pressburg will be completed next year. The railway, which will carry both passengers and goods, will be operated by means of direct current in the metropolitan area of Vienna, and by three-phase alternating current outside the city limits. The length of the railway will be 43⅜ miles, of which the greater portion is in Austria, and only 5 miles in Hungary. In Vienna the power will be furnished by the municipal electricity works, while a power station at Regelsbrunn will serve a similar purpose for the remainder of the track. It is intended to use motor-cars for the passenger service, and electric locomotives for goods traffic, which latter will specially consist of food products brought from the country districts to the towns. Of the various schemes relating to the South Tyrol, it is reported that one for a line between Trient and Mezzolombado-Malé has the prospect of being carried into effect. It would have a total length of 50 miles, and a branch line would be formed to San Michale. About 30 per cent. of the expenditure is to be borne by the local authorities, and the remainder by the State.

Belfast.—On the 26th inst. the first electrically-driven car made a trial trip from Andersontown depôt to the Dunville Park junction. The power was derived from the old plant temporarily erected in the Asylum grounds. The training of drivers on this section will now be commenced.

Berlin.—A Reuter telegram says that the supervisory board of the Great Berlin Tramway Co. has unanimously sanctioned the proposal of the directors for the conversion of the service into an underground system in certain streets where the traffic is particularly heavy. The cost of the change is estimated at 60,000,000 marks (£3,000,000).

Cheshire.—Parliamentary powers are to be sought next session for constructing a tramway from Cheadle to Wilmslow. It will join the existing Stockport line, and be carried through Handforth, a branch being made to connect with Bramhall. From the latter place a line will be carried eastward as far as Macclesfield along the broad and picturesque highway. In this way it is proposed to form a tramway connection between Stockport and Macclesfield.

Cockenzie.—In connection with the proposal put forward some time ago to run electric cars from the Levenhall terminus of the Musselburgh system to Cockenzie, Mr. E. A. Mitchell, chief engineer to the National Electric Construction Co., Ltd., has just concluded an examination of the proposed route, for the purpose of preparing a plan for presentation to Parliament, and

should Parliamentary sanction be received, the work will be proceeded with. The line will be a single one for the greater part of the route and will lie along the sea shore.

East Ham.—The T.C. has resolved, upon the recommendation of the Tramways Committee, that until Barking is prepared to accept the terms submitted to it, no further action shall be taken in the matter of the proposed tramway lease. From a report presented by the treasurer, it appears that for the four years ending March 31st last the net profit on the tramways undertaking amounted to £3,055. The sum of £1,305 was allotted to depreciation and reserve, and the balance, viz., £1,750, to the relief of the rates (equivalent to 1d. rate). The total capital expenditure to March 31st last was £152,277.

Glasgow.—The Tramways Committee of the T.C. has decided to proceed with a portion of the extension authorised by the Act of 1904, from Giffnock to Thornliebank.

A deputation of ratepayers waited upon the Tramways Committee of the Glasgow T.C., urging the extension of the car service to Millerston. Mr. Alexander, the convener of the committee, replied favourably on the proposal. The committee has also favourably considered a proposal to extend the tramways to Clarkston.

Liverpool.—On Monday morning an accident of an unusual kind occurred at Herculaneum Dock Station on the Overhead (electric) Railway, Liverpool. Through the breaking of an axle, a length of rail in the middle of the track was torn from its position and forced through the bottom of a third-class carriage and into the motor compartment, the end passing through the roof of the latter. It was four hours before the double line was again in perfect working order. A number of passengers were in the damaged carriage, but fortunately escaped serious injury.

London.—According to the *Daily News*, Mr. J. R. Chapman, engineer to the Underground Electric Railways, has designed a special storage battery car, capable of hauling a train in case of breakdown of the normal power supply system. In the words of the sagacious chronicler, "the body contains 160 cells, each using 8 gallons of sulphuric acid, *in addition to a number of storage batteries.*" The italics are ours. Messrs. Hurst, Nelson and Co. are the makers of the car which is being used in the construction of the new tube railway.

Camberwell.—The B. of T. has notified the B.C. that after consideration of the objections brought forward, and the L.C.C.'s reply thereto, the Board has approved of the plans of the County Council's proposed tramways within the borough.

Poplar.—The L.C.C. has written to the B.C. stating that further surveys have been made with the view of ascertaining whether it would be practicable to adopt the conduit system on the tramways in the borough. The result of these has shown that the difficulties and inconvenience which would be inseparable from the system, prevented the Highways Committee from recommending its adoption. The General Purposes Committee of the B.C. reported on Wednesday that it had agreed to the adoption of the overhead system, and it urged Stepney B.C. to take similar action.

Maidstone.—The past year's working of the municipal tramways has resulted in a net profit of £1,531.

Manchester.—Last week a trolley-head became fast in the overhead points, and the pole snapped at the standard. The trolley arm descended with great force on the head of the only outside passenger, who was slightly injured.

North London.—The new electric tramway from the Archway Tavern to Highgate Archway, connecting with the through line to Finchley and Whetstone, was completed last week. The section, which is half-a-mile long, and has been constructed jointly by the London and Middlesex County Councils, now makes a through connection between the City and Totteridge, a distance of 10 miles. The extensions from Green Lanes to the Alexandra Palace, by way of Hornsey and Muswell Hill, are also completed, and are to be formally opened next month.

Oxford.—The official circular of the Tramways and Light Railways Association for September contains full copies of the reports of Messrs. Worbey Beaumont and Stephen Sellon to the Oxford Corporation on the comparative merits of motor-omnibuses and electric tramcars, together with a table showing how they compare with the present horse tramways.

South Africa.—Port Elizabeth.—A Government inquiry was opened on August 24th to inquire into the two recent tramway accidents at Port Elizabeth. Amongst others on the Commission were Mr. H. C. Becker, president; Mr. Denham, Cape Government electrician; Mr. Wilson; and Mr. J. Barclay, tramway manager.

Torquay.—The T.C. on Monday agreed to the Dolter Electric Traction Co. laying down altered tramway routes only on the condition that, in the event of the Council being further prevented from supplying the power for the tramways, the company would relieve it of its obligations under the agreement. The Council rejected a motion consenting to the Dolter Co. laying tramways along Torbay Road.

Wednesbury and Darlaston.—The electric cars between these towns commenced running on Tuesday, and were very well patronised. This track, which is 1 mile 1,000 yds. in length, and the fare for the entire length of which it is stated will be 1d., forms a rather important section, not only as connecting Wednesbury with Darlaston, but as completing the network of tramways between West Bromwich, Wednesbury, Darlaston and Walsall. The completion of this section of line does not, however, terminate the operations of the Birmingham Joint Committee, in which is vested the running powers of this, as well as of many other tramway tracks in this district—the local authorities retaining the right to purchase at the expiration of a given period—for the Committee intends to construct an electric tramway from Wednesbury to Dudley.

West Ham.—The borough treasurer reported at the meeting of the Corporation on Tuesday that after a careful estimate of the accounts up to date, he was unable to anticipate any surplus on the tramway undertaking for the current financial year.

TELEGRAPH AND TELEPHONE NOTES.

Brighton Telephones.—The L.G.B. has sanctioned the borrowing by the T.C. of £6,145 out of the sum of £11,617 applied for. Part of the letter of the L.G.B. was held over for further consideration. It would be interesting to know whether the Board recommended the Council to sell the undertaking to the Post Office.

C.S. "Colonia" Repaired.—The cable ship *Colonia* has completed the repairs rendered necessary by her recent grounding off Canso, and has proceeded to sea to complete the work on which she was engaged.

Egypt.—The State Telegraph Department is about to lay for the Telephone Co. two new circuits or lines between Cairo and Alexandria which, when completed next year, will greatly relieve the present pressure on the two lines that have been in use now for three years. There will also be another line between Cairo and Tantah, and Alexandria and the latter place, so that in future messages can be transmitted direct between the two cities and Tantah. Part of the work on this line has been finished, and the remainder will be completed as soon as the necessary grant has been obtained by the Telegraph Department. In this connection the *Egyptian Gazette* is informed that, should the new service to Tantah prove a commercial success, there is every probability that the system will be extended to other important towns, such as Zagazig, Port Said, Mansourah and, perhaps, Suez.

Paris Telephones.—Something like a riot took place recently at the Paris Central Exchange, owing to the dissatisfaction of the female employés, most of whom receive only £40 per annum, rising to a maximum of £72. Not only are the operators underpaid, but their work has been increased, it is said, very greatly during recent years, with the result that many of them are much overworked.

Swansea.—The National Telephone Co. has offered to take over and pay for the municipal undertaking at its present paper value, or to sell to the Corporation the undertaking of the company in the Swansea exchange area on similar terms. The L.G.B., referring to the application of the T.C. for sanction to borrow £7,000 for the extension of the telephone system, has inquired whether it has considered the question of entering into negotiations with the Postmaster-General with the view to the absorption of the undertaking by the Post Office. The Committee has instructed the chairman to confer with the Postmaster-General on the subject.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Trinidad-Demerara (No. 1)	Aug. 26, 1901	..
Dominica-Martinique	May 7, 1902	..
St. Lucia-Martinique	May 7, 1902	..
Cayenne-Pinheiro	Aug. 13, 1902	..
Reissa-Issa (Yemen) Camaran	Oct. 22, 1902	..
Tarifa-Tangier	Jan. 18, 1904	..
Closed { Vladivostock-Nagasaki	Feb. 9, 1904	..
Closed { Port Arthur-Chifu	Mar. 9, 1904	..
Jamaica-Colon	Jan. 5, 1905	..
Cadiz-Tenerif	July 20, 1905	..
Landlines.		
Puerto-Barrios	July 28, 1902	..
Kertch-Soutchoum	Sept. 27, 1904	..
Alaska landlines	Aug. 27, 1905	Sept. 20
Communication with Brazil *via* Galveston	July 18, 1905	..
Alaska landlines	Sept. 23, 1905	..
Rome-Constantinople	Sept. 22, 1905	..

Time Signals.—In Paris, says the *Morning Post*, a method of utilising the telephone system to transmit time signals and to regulate clocks is being worked out by the Observatory of the Bureau of Longitudes. The regulation is effected by the direct transmission of the sound of the pendulum by means of a special microphone contained in the case of the time-instrument, and without the use of any electric contact that might interfere with the movement. The sender indicates with his voice the first two or three beats of the pendulum, and the receiver continues to count the beats as he hears them himself. The Bureau of Longitudes has furthermore organised a service of daily comparisons between different stations over the country, so as to deduce from the Paris time exact differences of longitude. All the stations connected by trunk telephone lines with Paris can now obtain mean time with the precision furnished by the astronomically-regulated clocks of the Paris Observatory.

Trans-Saharan Telegraph.—According to the *Times*, M. Etiennot, who has been in charge of the surveys for the Trans-Saharan telegraph, which is to link up Algiers with Timbuktu, has just successfully concluded his mission. The total length of line will be about 2,500 miles.

Venezuela.—A Reuter telegram states that the *New York Herald* publishes the following from Caracas:—"Communication between the French company's coast cables and the Caracas office ceased on September 16th in virtue of President Castro's decree, which imposes a fine of 500 Bolivars for the violation of the order." (500 Bolivars equals about £50). The French Minister has protested against the closing of the French cable stations and the expulsion of M. Brun, the manager.

The New York correspondent of the *Globe* states that the actual position for the moment appears to be that the company is allowed to keep open its station at La Guayra, where the cable lands, paying the Government a royalty of a franc for every message entering or leaving the country, and handing over its inward traffic for transmission by the Government land lines. Meantime a new contract will be negotiated between the company and the Government.

Wireless Telegraphy.—Negotiations are in progress between the authorities at Trinity House, the Marconi Co., the Admiralty and the Board of Trade which will result, should they conclude satisfactorily, in six well-known lightships being fitted with Marconi installations for the transmission and receiving of wireless messages. The six lightships in question are the *East Goodwin*, the *South Goodwin* and the *Gull*, vessels which lie off the Kentish Coast between the North and South Forelands; the *Tongue* lightship, which lies well out in the Thames estuary, some miles off Margate; the *Sunk*, a ship anchored off Walton-on-the-Naze; and the *Cross Sands*. The last-named lightship (according to the *Standard*), which is anchored 7 miles off Yarmouth, in the thick of the stream of North Sea traffic, is now being fitted with wireless telegraph apparatus, permitting the crew to summon lifeboats from Yarmouth, Gorleston and Caister. This is also of the utmost importance to steamers fitted with wireless apparatus, in case assistance should be required with the least possible delay.

It is said that Major Wetmore, an American automobilist, has constructed a wireless telegraph receiver instrument which is placed in the tonneau of his car, while a transmitting apparatus is placed in a neighbouring railway station. Over distances of 20 miles and under the Major, who is a millionaire, now keeps in constant touch with the rise and fall of stocks in which he is interested. There is no reason, according to Major Wetmore, why brokers owning automobiles should not equip them with the apparatus, which is simple, not unsightly, and efficient, and thus have many days in the country doing business in the open air. Fortunately, the report is probably, as Mark Twain would say, "greatly exaggerated." Otherwise a new terror would be added to automobilism.

The action of the Natal Government in refusing to grant a concession to the Marconi Wireless Telegraph Co. to establish a station at the Bluff, Durban, has been the subject of much comment. It is reported that the Ministry acted on the advice of the Imperial Government, which represented that it was not desirable to vest a monopoly in private hands. The terms offered to Natal are not so favourable as those offered to the Imperial Government, and the Natal Government desires first to examine into other methods, such as the De Forest system, and contemplates the possibility of working a wireless system itself.

"The Johnson Secret Wireless Telegraph and Telephone Testing Syndicate, Ltd., invite tenders from builders and contractors for work in connection with the installation of the syndicate's system of secret wireless telegraphy," at a Martello tower in Sussex. The foregoing is taken from an advertisement in the daily Press.

CONTRACTS OPEN AND CLOSED.

OPEN.

Barnes.—October 10th. Condensation water purifier and grease eliminator for the U.D.C. electricity works. See "Official Notices" to-day.

Bournemouth.—October 16th. Two passenger lifts on the East and West Cliffs for the T.C. See "Official Notices" to-day.

Chiswick.—September 29th. Wiring refuse destructor and other buildings for the U.D.C. See "Official Notices" September 15th.

G. W. Railway.—October 16th. Stores for one year. See "Official Notices" to-day.

London.—September 29th. Thirty-four tramcar bodies, trucks, equipments, &c., for the L.C.C. See "Official Notices" September 1st.

London.—October 3rd. Low-tension and extra high-tension cables for the L.C.C. See "Official Notices" September 15th.

Metropolitan Railway.—October 9th. The directors invite tenders for the supply of general stores during 12 months ending October 31st, 1906. Manufacturers and others desirous of tendering should apply to the secretary (Mr. R. H. Selbie), 32, Westbourne Terrace, W., for a form or forms under the following numbers:—

18. Electric lamps, carbons, ebonite, fuses, &c.
19. Electric wire casings, and wood wool.
20. Electric wires and cables.
45. Telegraph fittings, battery jars, zincs, insulators, &c.

Mussoorie (India).—October 23rd. Supply and erection of steel power pipes, water motors, alternators with exciters, switchboards complete, transformers, induction motors, pumps, workshop machines; also bare copper overhead mains, insulators, and lightning arresters, arc and incandescent lamps, telephone equipment, workshop tools and general stores. See "Official Notices" July 14th.

Pontypridd.—September 30th. Cables and overhead equipment for U.D.C. tramways. See "Official Notices" September 8th.

Roumania.—The municipal authorities of Tulcea are about to invite tenders for the concession for the electric lighting of the town.

Spain.—October 14th. The Spanish Ministry of Public Works in Madrid is inviting tenders until October 14th, for the concession for the construction and working of an electric tramway in Saragossa. Particulars may be obtained from, and tenders are to be sent to, El Ministerie de Obras Publicas, Madrid.

Spain.—Tenders are at present being invited by the municipal authorities of Martorell (Barcelona province) for the concession for the electric lighting of the town.

Stoke.—The B. of G. are to invite tenders for replating battery, mains repairs, and rewiring of the cottage Homes, hospital laundry and other buildings wherein the electric wiring is defective. The cost is estimated at about £540.

CLOSED.

Caerphilly.—The U.D.C. has accepted the tender of Messrs. Johnson & Phillips, Ltd., for cables, &c., in connection with the electrical scheme, at £4,248.

Chester.—The Corporation has renewed its contract with the Sunbeam Lamp Co. for the whole of its supply of lamps for the next 12 months.

Ebbw Vale.—In connection with the installation of electric street lighting, the following tenders have been accepted:—

Cables, Messrs. W. T. Glover & Co., £3,708.
Overhead wires, Messrs. R. W. Blackwell & Co., £6,159.
Street lamps, Electric Glow Lamp Co., £588 4s. 6d., or with Nernst lamps, £643 12s. 6d.
Meters, the Reason Manufacturing Co. and Messrs. Rumney.

Finchley.—The British Accumulator Co., Ltd., have just secured the contract from the U.D.C. for two large storage batteries required at its new sub-station, at £2,761 10s. The same company has also several orders in hand at the present time, inclusive of export orders for Canada and India, and for private installations. Their various types of cell are shown at Olympia.

Glasgow.—Messrs. Matthews & Yates have secured the offer (£70) for electric fans for the new church which the Corporation are erecting.

The Tramways Committee of the T.C. have accepted the following offers:—

Copper and mica segments, the British Thomson-Houston Co.
Detectors for head office, the May-Oatway Fire Appliances Co.
Routes, stages, fares and gummed slips, Mr. James Cameron.
Teak, Messrs. Wylie, Stewart & Marshall, and Messrs. Robinson, Dun & Co.
Sixteen-core telephone cables, the National Conduit & Cable Co., Ltd.
Bonds, the Lahmeyer Electrical Co., Ltd.
Test plug boards, Messrs. Estler Bros.
Lead-covered power cable, W. T. Glover & Co., Ltd.
Telephone test cable, the National Conduit & Cable Co., Ltd.
Movable points, Hadfield's Steel Foundry Co.

For the new tramway extensions the following, being the lowest offers, have been accepted:—

Mr. William Dobson, Edinburgh, for the extensions to Killermont Bridge, Lambhill and Pollokshields.
The British Electric Equipment Co., London, for the Baillieston and Barlinnie sections.

The offer of the National Conduit & Cable Co., Ltd., for trolley wire has been accepted, it being the lowest.

Hammersmith.—The B.C. has accepted the tender of the Mains Colliery Co. for best Thro' and Thro' No. 1 steam coal as required up to March, 1906, at 13s. 9d. per ton, delivered at the wharf.

South Africa.—East London.—At a meeting of the Town Council on August 24th, it was recommended to indent for one standard feed pump, at an estimated cost of £80. Also ten "Brockie-Pell" open-type arc lamps, for operating ten in series off 500 volts, for the lighting of the Esplanade, at an estimated cost of £217, and also sufficient arc lamps to replace the present incandescent lamps in Oxford Street, between St. George's Road and the top of Oxford Street.

Premier Diamond Mine (Transvaal).—The contract for the

installation of a telephone system for this mine has been let to Messrs. C. C. George & Co., agent for the British Westinghouse Co., of Johannesburg, for £2,010. The equipment is of the Western Electric Co's. make; "Central Battery" system, with a provision for 100 lines, 23 of which will be taken up as a start, all the lines being laid underground.

Swindon.—The B.G. has accepted the tender of Mr. J. Lott for the supply of electric cable, at £1 12s. 6d. per 220 yds., and that of Messrs. Bays & Co. for electric lamps.

Tottenham.—The U.D.C. has accepted the tender of Messrs. Evered & Co., at £203, for electric light fittings for the Council chamber, committee rooms, &c.

Walthamstow.—The U.D.C. has accepted the tender of Messrs. Chas. Booth & Co. (Liverpool) at £24 for a Crellins patent armature removing bogie.

West Ham.—The Corporation on Tuesday received the following tenders for a 5-B.H.P. alternating-current motor for driving the mechanical stokers at the generating station:—

Crompton & Co.	(accepted)	£58 10
British Thomson-Houston Co.		59 0
Fuller-Wenstrom Co.		59 6

The Corporation has placed an order with Messrs. Edgar, Allen and Co., at £542 10s. 6d., for special work in connection with the new tramway junction at Barking Road. It has also accepted the tender of Mr. J. Wilson, Wandsworth, at £466 3s., for installing the electric light at the Hilda Road schools. In the event of the necessary contract not being entered into for any cause, the next lowest tender, viz., the District Electric Co., of Wolverhampton, at £500, is to be accepted.

FORTHCOMING EVENTS.

Monday, October 2nd, at 7.30 p.m.—Society of Engineers. Meeting at the Royal United Service Institution. "Machine Drills for Hard Rock," by Mr. A. H. Smith.

Thursday, October 5th.—At 8 p.m. Rugby Engineering Society. Annual general meeting at the Benn Building, High Street. Lecture by Mr. J. Sugden on "Protection from Electric Shock," with demonstration on treatment after a shock.

NOTES.

Educational Notes.—The "Announcements" of the Northampton Institute, St. John Street Road, E.C., give particulars of day and evening courses in Engineering (Mechanical and Electrical), Technical Optics, Artistic Crafts and Horology, as well as evening classes in great variety. The latter commenced on Monday last, whilst the former begin on Monday next. The principal, Dr. R. M. Walmsley, is head of the department of Electrical Engineering and Applied Physics, and with him is associated Dr. C. V. Drysdale. The courses provide preparation for the degrees of London University, the Institute being one of the Institutions from which candidates can be presented for examination as "Internal Students." The laboratories are well-equipped with apparatus, and the engineering staff includes many men of high professional standing and attainments.

The South-Western Polytechnic, of Manresa Road, Chelsea, has issued its calendar and prospectus of day and evening classes for the new session. Besides instruction in a great variety of subjects—scientific and commercial, domestic and social—excellent courses in mechanical and electrical engineering are provided, with special arrangements for students of London University. Mr. A. J. Makower is the head of the Electrical Department, which is well equipped with apparatus for practical work, and Mr. U. A. Oschwald is senior demonstrator.

The L.C.C. School of Marine Engineering, High Street, Poplar, is appropriately situated close to the docks, and provides courses on Marine Engineering and Navigation, both day and evening. Instruction in electrical engineering is given by Mr. J. P. Yorke. The principal is Mr. H. A. Garratt.

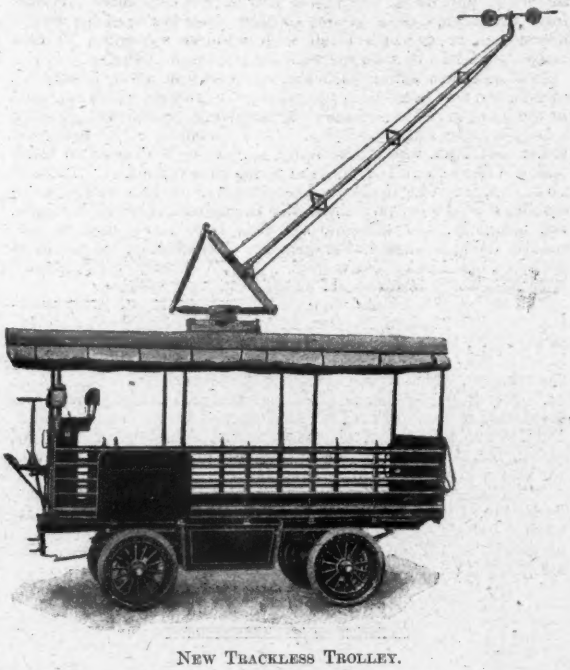
Prof. Andrew Jamieson, M.Inst.C.E., of Kelvinside, Glasgow, announces the resumption of his Correspondence Classes in Electrical and Mechanical Engineering for the winter session. Correspondents may enrol at any time and in any stage; special arrangements are made for those preparing for the A.M.Inst.C.E. examinations. Prof. Jamieson's long and successful experience in teaching engineering places him in an exceptionally favourable position for the conduct of this kind of instruction—he has had over 5,600 students and correspondents on his registers during the past 25 years.

The University of Liverpool offers degrees in engineering and science, and we have received a copy of the regulations for the session commencing on October 2nd. Prof. E. W. Marchant is head of the department of Electrotechnics, while Mr. A. Bromley Holmes is Associate Professor, dealing with Municipal Electrical Engineering—which is a new title, and evidently represents something different from electrical engineering proper. There is, however, no Chair of Municipal Finance. Lecture and laboratory courses for day and evening students have been organised.

The Birkbeck College, which has now completed 82 years of educational work, will commence the new session on Monday, October 2nd, when Sir Edward Fry will give the opening address at 7.30 p.m.

City and Guilds of London Institute.—Finsbury Lectures.—The winter session of practical instruction and lectures opens next week, the advanced course on Mondays being devoted to "Alternating Currents," by Mr. H. H. Simmons, and to "Transformers, Arc Lamps and Dynamo Design," by Prof. Silvanus Thompson. The elementary course, held on Wednesday evenings, includes lectures by Prof. Thompson on the "Magnetic Properties of Iron and Steel," and by Mr. Hampshire on "The Electric Circuit" and on "Galvanometers." The new wing of the Technical College is nearly completed, and it is expected that the new drawing office and heat laboratory will be ready for use at the new year.

New Trackless Trolley Service in Italy.—An electrical motor vehicle service for the transport of both passengers and goods has recently been started between Pescara and Castellamare, Italy, the cars taking their current from overhead conductors similar to electric tramways. The system is known as the Cantone, introduced by Messrs. C. Frigerio & Co., of Milan. The conductors, there being two, owing to the absence of a rail to serve as the return, are carried on masts 20 ft. high. The trolley is carried at the end of a 20-ft. conducting rod, the latter being held in such a way that there is no danger of the trolley leaving the conductors. The passenger vehicles have seating capacity for 12 persons, while the goods wagons are adapted to carry a load of 3 tons; the electromotor is geared to the rear axle, while the



New Trackless Trolley.

control mechanism is similar to that adopted in tramcars; the long trolley arm gives the cars a radius of about 12 ft., enabling them to pass any vehicle met with on the road. The passenger cars can attain a maximum speed of 12½ miles per hour. Owing to the increased road resistance the consumption of energy is about double that of electric tramcars, but on the other hand, it is pointed out that the cost of installation is much less than that of tramways, averaging only £900 per kilometre, as against anything from £3,000 to £6,000 for tramways.

Electrolytic Refining of Silver.—Mr. A. G. Betts has taken out an American patent for a process of refining crude silver containing bismuth. The alloy is used as anode in an electrolytic cell, the electrolyte in which contains a strong monobasic, non-oxidising acid in the free state. The bismuth thus passes into solution, to be afterwards precipitated by means of metallic lead. The excess of lead is next removed, and the resulting solution, containing silver only, is finally electrolysed to obtain the pure metal. In the first process an arrangement is fitted to the apparatus to prevent the growths upon the cathode from extending across the liquid.

Synthetical Alcohol.—According to an article by H. Hanow in the *Chemiker-Zeitung*, synthetical alcohol is being manufactured on the large scale at St. Alban des Villars, in Savoy. A mixed metallic carbide, prepared by heating the appropriate oxides and coke in an electric furnace, is treated with water, the gas ethylene being evolved. This is absorbed in sulphuric acid, so as to produce ethylsulphuric acid, and the latter, on dilution with water, yields alcohol. The by-products of gas generation and the spent acid are used over and over again, so that, except for unavoidable losses, only carbon is required as a raw material. It is stated that the quantity of coke needed to give one hectolitre of alcohol, which should theoretically be from 59 to 63 kilogrammes, is at present about 200 kilogrammes.

Steel Railway Carriages.—Writing to the *Times* of 23rd inst., Mr. G. C. Cuningham, general manager of the C.L.R., says:—"In your issue of the 19th inst. there is an account of a visit of a number of Press representatives, by invitation of the Brush Electrical Engineering Co., to inspect at the car depôt of the Metropolitan District Railway what is described as the 'first steel railway carriage constructed in this country.' The report then goes on to say:—'Six steel railway carriages have also been running for more than two years on the Central London Railway. These, however, were a product of the United States.' It is to this statement, and in particular to the latter part of it, that I desire to draw attention and to correct the error into which your representative has inadvertently fallen. These six steel carriages of the Central London Railway were built, to my designs, by the Birmingham Railway Carriage and Wagon Co., Ltd, of Smethwick, near Birmingham, and are entirely a British product, owing nothing to the United States. The credit of introducing steel railway carriages for passenger service belongs entirely to this country, for at the time these carriages began to run on the Central London Railway, there were no steel carriages in use in the United States. I venture to think that the use of steel in this work is important and will be largely adopted in the future; and it will, doubtless, be interesting to know that an English firm first began the work. I cannot claim, as your representative attributes to me, to have designed the steel carriage now constructed by the Brush Co. I placed my design at their service, and, while following it in most respects, they have introduced important modifications and changes, rendered necessary undoubtedly by the service required of the car, but which essentially alter the design." It is gratifying to find that this country was first in the use of steel, which has been widely adopted of late in the U.S.A.

The Selection of a Main Switch.—Main switches are largely used, and have important functions to perform in all power and lighting installations, and of the many designs offered some present characteristics which render them undoubtedly superior to others. In selecting a main switch for a current up to 250 amperes, decision should be made in favour of the "knife" design for the following reasons. The "knife" design allows of the contacts being placed a maximum distance apart, a highly important point especially when dealing with considerable currents at 250 or 500 volts pressure. Another point in favour of the "knife" switch is that the construction is solid and simple in character. Preference should be given to a switch which has a considerable number of laminations on the faces of the contact clips, as each lamination means a certain amount of metal actually in contact with the current-carrying blade of the switch. The number of laminations provided by some makers is quite insufficient, and the metallic surface actually in contact with the blade is so small that an unnecessary drop of voltage takes place across the switch. In the case of main switches of large carrying capacity, say, from 250 to 5,000 amperes, one particular design stands far in front of all others in efficiency, namely, the "multiple leaf" type. In this type of switch the "bridge" which actually carries the current when the switch is closed, is built up of a large number of strips or laminations of hard rolled high conductivity copper, so formed that when the switch is in the "on" position the end of each lamination makes a separate and actual contact with the contact blocks. The "leaves" of copper from which the bridge piece is built up are extremely thin, say, 34 S.W.G., and are so arranged that each lamination cannot fail to make its own area of contact. Such a method of construction is certainly far preferable to any other at present offered, in view of the fact the C^2R loss becomes a serious matter where large currents are carried. In these large capacity switches it is absolutely imperative that a carbon break should be fitted, inasmuch as should this detail be omitted the spark at the final break will soon burn the surface of the main contact, and will thus enormously reduce its carrying capacity. It may be added that in the case of a switch for breaking very large currents, the addition of a magnetic blow-out is highly desirable.

Electrical Production of Steel.—The example of the Aluminium Industry Co., of Neuhausen, in the matter of the electrical production of steel by the Héroult system is now being followed by the Allgemeine Calcium Carbid Genossenschaft, of Gurtnellen, which has decided to enlarge the scope of its operations by taking up the Kjellin method for the manufacture of steel. An extraordinary general meeting of the members of this corporation has sanctioned the project, and also authorised an increase in the share capital for the purpose. It is expected that the work will be commenced this year, the corporation already having a furnace of 500 H.P. In this connection it is of interest to note that the directors of the Rochling Iron and Steel Works, of Volklingen, decided some time ago to install a similar furnace of 1,500 H.P. It is also reported that other iron and steel works in the iron ore districts of Lorraine and Luxemburg propose to extend their operations by the adoption of similar plant.

Electrolytic Manufacture of Lead Peroxide.—A German patent has been taken out by F. R. Steigelmann for an electrolytic process of preparing lead peroxide from natural or artificial lead sulphide. The sulphide is employed as anode in an electrolyte consisting of simple water to which sufficient acid, alkali, or saline matter has been added to render it a conductor. During the operation the sulphur of the sulphide is converted into sulphuric acid, the lead into peroxide, and any foreign metals which may be present pass into solution, or are deposited on the cathode. When acid is employed to confer conductivity upon the water, care must be taken to avoid excess, or sulphuretted hydrogen and lead sulphate may be produced; and when sulphuric acid is adopted, it should be introduced drop by drop until the P.D. in the cell is 3 or 4 volts, when the current density is 1·5 amperes per sq. cm. of positive electrode. The quantity of sulphuric acid used must not reach 1 per cent. until a considerable amount of peroxide has been recovered; then the acidity may be gradually increased a little. The process is carried out in troughs divided into a number of compartments, which are connected alternately with the positive and negative conductors.

Electrical Labour Troubles in Berlin.—The *Times* correspondent at Berlin says that a great lock-out on the part of the Siemens-Schuckert and the Allemeine Elektritzitäts Gesellschaft was announced on 21st inst. The lock-out was caused by the failure of the employers to come to terms with two classes of workmen, the screw makers and the packers, regarding the price of piece-work. Owing to the attitude of these workmen it was impossible to continue operations. The men seem to have decided that, if the employers refuse to yield, an attempt will be made to organise a general strike, which would affect 50,000 people employed in the Berlin electric industry. The employers believe that the strike funds of the different trade unions have been so exhausted by recent partial strikes that a general strike could not be of very long duration.

A Reuter dispatch dated 23rd inst. reported that the companies had at the instance of the workmen's committees declared their readiness to abide by the concessions they granted before the outbreak of the strike, and to resume the working of the closed works on the 27th inst., and to take on the men again in so far as the conditions permitted it, provided that the representatives of the factory committees, as representatives of the whole body of the workmen, declared by the 25th inst. that the strikes were ended, and that all other demands of the men previously put forward were withdrawn.

In regard to the origin of the trouble, Reuter says that the men claimed that the cost of living had increased so much through the high price of meat and other necessaries that their present wages were insufficient, and they demanded a minimum wage of 27s. per week for the lowest class of unskilled labour. The companies maintained that it was impossible to grant the increase of 15 per cent. demanded by the employés, as they had already reduced the working day from ten to nine hours. They also declared that the ruling prices for their goods were too low to permit of an increase of more than 5 per cent.

At a meeting on Tuesday, the men resolved by an overwhelming majority not to resume work under the conditions proposed by the masters. It is reported that the companies have decided to lock out all their employés to-morrow (40,000 in number), the works closed including the apparatus factories in the Ackerstrasse and Huttenstrasse, the machinery works in the Brunnenstrasse, the turbine factory in the Huttenstrasse, belonging to the Allgemeine Elektrizitäts Gesellschaft, the pulley works belonging to the Siemens-Halske Co. in the Helmholtzstrasse, the dynamo works in the Franklinstrasse, and the cable works in the Nonnendamm, belonging to the Siemens-Schuckert Co.

Acting on the acute example set by the Germans in the past, British workmen will no doubt contribute to the support of their trade union *confrères*, so as to keep them out of work as long as possible!

Incorporated Municipal Electrical Association.—The Council of the Incorporated Municipal Electrical Association visited Barrow-in-Furness on Saturday last, and was hospitably entertained by the mayor of the borough. After the luncheon, Mr. Edgcome, of Kingston-on-Thames, made some special remarks concerning the good work of Mr. Alderman Smith, of Barrow, on the Council; and in reply, the latter said he believed that the working together of the electrical engineers and the chairmen of electricity committees was for a common good, practically and financially. The Barrow Electricity Works, which have in six years cost £92,555 3s. 10d., and are at present being extended, and Messrs. Vickers, Sons & Maxim's Naval Construction Works, where electricity is the chief motive power, were visited.

Charge against a Tramway Manager.—Mr. J. W. Endean, until recently manager of the Devonport and District Tramways Co., Ltd., was charged at Devonport on 20th inst. with misappropriating the sum of £4 10s., the cost of a season-ticket on the system. The prosecution intimated that several other charges would be preferred against defendant. After formal evidence Endean was remanded until Wednesday, bail being allowed.

It is reported that the accused, who was to have appeared before the Devonport magistrates on Wednesday morning on a charge of embezzling money belonging to the Tramway Co., was arrested in Swansea early on that day. At the first hearing on Wednesday last week Endean was allowed bail, himself in £200 and two sureties of £100. A detective left on Wednesday for Swansea, and the accused was to be taken back to Devonport that night.

Appointments Vacant.—Canvasser for Loughborough electricity department (£1 + 6d. per 16-C.P. lamp); junior electrical shift engineer for East Sussex County Asylum; junior assistant for Limerick electricity works (30s.); assistant for the Heriot-Watt College, Edinburgh, electrical engineering department (25s.); canvasser for Battersea electricity department (£2 + commission).

Gas.—A gas explosion occurred at Richmond on Tuesday, causing one death.

A Novel Electric Safety Lamp.—A novel electric safety lamp, due to Dr. Tommasi, is described in a recent issue of *La Energia Eléctrica*. The inventor has set himself the task of obtaining perfect safety in the use of electric glow lamps, thus adapting electric lighting to mines where firedamp is produced, as well as to powder factories and the like.

Electric glow lamps are known to be imperfect from the point of view of safety. If, as a consequence of some accident, the bulb is broken, the filament will be burned by its contact with the air. So far from being instantaneous, this combustion will, however, be attended not only by the projection of incandescent particles, but also by sparks, which, though very small, may be sufficient to ignite a mixture of air and gas, or of air and powder, as found in suspension at certain places, thus giving rise to an explosion.

In order to avoid this risk, the contact of the surrounding air with the incandescent filament should be avoided, and this problem has been solved in the new lamp. The lamp proper, which may be of any type, is mounted within a glass cylinder locked at one end by the support of the apparatus and at the other by a cover provided with a small key, this double lock being perfectly tight. The conductors are fixed to the screws carried by the support.

In the interior of the support there is a small rubber bellows intended to lift a metallic contact arranged within its lower part, thus interrupting the current, as long as the bellows is not filled with air.

In order to start the lamp, the bellows should be filled with air by means of a special rubber tube terminating in a pear-shaped bulb, when the contact will be established and the circuit completed. In order to extinguish the lamp, it is sufficient to turn a key, when the compressed air escaping from the bellows will separate the metallic contacts referred to above, thus interrupting the current.

If, then, for some reason or other the glass cylinder be broken, the pressure will drop and the volume of the bellows decrease, thus producing the same effect as operating the key. The contacts being accordingly separated, the current will be interrupted and the lamp put out.

If, in the place of the cylinder, the bulb of the lamp should be broken, the inside air would be expanded by a volume equivalent to that of the bulb, this being sufficient to contract the bellows, to interrupt the circuit and to extinguish the lamp.

The apparatus can be completed by the addition of one or two very light accumulators of the Tommasi system, so as to become portable.

OUR PERSONAL COLUMN.

[*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*]

Central Station Engineers.—At a meeting of the Coventry City Council on Tuesday, the recommendation of the Electric Light Committee that the salary of Mr. J. A. Jeckell, manager of the electric light department, be increased from £400 to £450 per annum, was adopted. Alderman West, the chairman of the Committee, said that during the year previous to Mr. Jeckell becoming manager there was a loss of £2,250 on the works, but last year the profits amounted to £1,321.

Mr. Pike has resigned the post of works superintendent at the Maidstone Corporation Electricity Works.

It was announced at the meeting of West Ham Corporation on Tuesday, that the electrical engineer, Mr. W. J. W. Bullock, had resigned his appointment in order to join the firm of Messrs. D. Bruce Peebles & Co., of Edinburgh, as chief of their contract department. Applications are to be invited for the post of electrical engineer at a commencing salary of £350, with annual increments of £50, to a maximum of £500 per annum.

In August last, the proposal came before the Devonport T.C. to increase the salary of its electrical engineer (Mr. J. W. Spare) from £275 to £300, dating from April 1st last, but the recommendation of the Electric Power Committee was not adopted. The Committee has now decided to recommend that the increase be granted dating from October 1st. Mr. Spark's able management of the undertaking has never been in any way questioned.

Our South African correspondent writes:—The appointment of Mr. J. F. I. Thomas, M.I.M.E. (who has been acting as resident engineer for Messrs. Mordey & Dawbarn, in Johannesburg) at a salary of £1,750 as general manager of the tramways and lighting department at Johannesburg, has just been confirmed by the Council, upon condition that he takes up his duties as early as possible. Mr. McMullen has been appointed resident engineer in charge of the generating station, and Mr. Coverenton (present acting manager) as distribution engineer, at £1,000 each. It has also been decided to invite locally applications for the post of tramway traffic manager, at a salary of £1,000 a year.

On Friday last, at the Ilford Electricity Works, Mr. J. L. Smith, late shift engineer, was presented with a handsome case of drawing instruments, suitably inscribed, by Mr. A. H. Shaw, chief electrical engineer, on behalf of the staff and employés. Mr. Smith has recently been appointed shift engineer to the Stepney Borough Council. Mr. W. H. Taylor succeeds him at Ilford.

Tramway Officials.—Mr. E. Edwards, on Friday, tendered his resignation as general manager of the tramways to the Gloucester Corporation Tramways Committee.

General.—On the occasion of his departure from Glenguoich, Western Highlands, where he had been spending a holiday with Lord Burton, His Majesty the King made a number of presentations. These included a silver cigarette case to Mr. F. McCullum, electrical and motor engineer on the estate.

Mr. A. W. K. Peirce, consulting electrical engineer of the Consolidated Gold Fields of South Africa, Ltd., and general manager of the General Electric Power Co., Ltd., Germiston, was entertained at a smoking concert by the employés of the latter company, on the occasion of his return from a visit to Europe and America. Mr. J. H. Powell, resident secretary, presided over a large and representative gathering.

The *Standard* says that Mr. A. J. Hewell, chief clerk at the Bristol post office, has been appointed postmaster at Bath. In 1862 he entered the service of the Electric Telegraph Co., and passed into the service of the Government when the telegraphs were transferred to the State in 1870. For many years he supervised arrangements for dealing with Press telegraphic work in Bristol, and was made telegraph superintendent in 1889, being promoted to chief clerkship in 1893.

Mr. Oswald Dewey, who has been for some time on the outside staff of Messrs. Ferranti, Ltd., Hollinwood, is about to join the Reason Manufacturing Co., Ltd., to take charge of their Birmingham office, and to represent them in the Midland district. The Reason Co.'s office is at 14, New Street, Birmingham, where correspondence may be addressed.

Mr. James MacIntosh, B.Sc., A.M.I.C.E., has been appointed lecturer to evening classes in electrical engineering at the Battersea Polytechnic. Mr. MacIntosh studied electrical engineering at Glasgow University when he took the degree of B.Sc., and was trained in the works of Messrs. Kelvin & White, being for some time in Lord Kelvin's laboratory. He is at present chief assistant to the manager of the Alliance Electrical Co. in charge of the engineering department, and is the inventor of an automatic booster.

Mr. H. Rayner, electrical engineer, Cleckheaton, was driving a motor-car at Dunsforth, near Boroughbridge, and he turned the car into a field where the party were to begin shooting. It fell into a dry ditch, and the occupants were thrown out. Mr. Rayner was pinned beneath the car, and sustained severe injuries to his collar-bone, ribs, and other parts of the body.

NEW COMPANIES REGISTERED.

Consolidated Supply Co., Ltd. (85,838).—This company was registered on September 14th, with a capital of £50,000 in £1 shares (25,000 6 per cent. preference), to adopt agreements (1) with the Consolidated Electrical Co., Ltd., and (2) with Patents and Industries, Ltd., and to carry on the business of electrical engineers, electricians, suppliers of electricity for light, heat, motive power or otherwise, manufacturers of and dealers in apparatus and things for use in connection with the generation, distribution, supply, accumulation or employment of electricity, to construct, lay down, establish, fix and carry out all necessary cables, wires, lines, &c., in connection therewith, and to carry on the business of proprietors and builders of tramways, railways, omnibuses, coaches, carriages and other vehicles, dealers in rolling stock, iron, brass and steel fenders and rollers, wire drawers, tube makers, smiths, stampers, builders' merchants, hardwaremen, &c. The first subscribers (each with one preference share) are: J. W. A. Wymark, 149, Kennington Road, S.E., clerk; E. P. H. Evans, 5, New Square, Lincoln's Inn, W.C., clerk; F. J. Copland, 10, Serjeants' Inn, E.C., clerk; A. J. Smith, 3, Burgoyne Road, Harringay, N., secretary; A. F. Sims, 10, Serjeants' Inn, E.C., solicitor; R. O. Watt, 29, Pemberton Road, Harringay, N., clerk; and J. Irwin, 123, Charterhouse Street, E.C., clerk. No initial public issue. The number of directors is not to be less than three nor more than four; two of the first are to be appointed by the subscribers and two by the Consolidated Electrical Co., Ltd., either before or within six months after the first general allotment of shares. One of the nominees of the Consolidated Electrical Co., Ltd., is (whether chairman of the board or not) to have a second or casting vote, and neither of them are to be liable to retirement by rotation while any of the purchase consideration remains unpaid or any debentures are held by the said company. If the whole of such purchase consideration be paid and such debentures (if any) redeemed, one of such directors is to vacate office and the other to remain but without a second or casting vote, so long as the said company holds 5,000 preference shares. Remuneration (except managing director), £50 each per annum. Registered office, Pulbro' Lodge, Northampton Park, Canonbury, N

Commercial Cars, Ltd. (85,816).—This company was registered on September 12th, with a capital of £20,000 in £1 shares (10,000 7 per cent. cumulative preference), to carry on the business of constructors of, and dealers in, motor-cars, lorries, boats and vehicles (whether propelled by electricity, steam, or other power), mechanical and electrical engineers, iron-founders, tool makers, brassfounders, owners of tramways and light railways, &c. The first subscribers (each with one preference share) are:—H. C. B. Underdown, 79, Gracechurch Street, E.C., merchant; A. O. Crichton, 79, Gracechurch Street, E.C., merchant; J. A. Halford, Hill End Farm, Sundridge, Herts, engineer; F. H. Mitchell, May Ford House, May Ford, Woking, gentleman; H. G. Hutchinson, B.A., Shepherd's Gate, Coleman's Hatch, Sussex; F. W. Rowley, Willapark, Wallington, Surrey; and E. F. Bath, 79, Gracechurch Street, E.C., clerk. No initial public issue. The number of directors is not to be less than two nor more than six; the first are H. C. B. Underdown and H. G. Hutchinson, B.A.; qualification, £50; remuneration, £100 each per annum and a share in the profits in excess of 20 per cent. on the issued capital. Registered office, 79, Gracechurch Street, E.C.

Patent Conveyor Co., Ltd. (85,803).—This company was registered on September 11th, with a capital of £2,000 in £1 shares, to carry on the business of electrical and mechanical conveying and ventilating engineers, machinists, millwrights, manufacturers of motor and other cycles and carriages, tube-makers, electro-platers, india-rubber manufacturers, lamp-makers, galvanisers, makers of steam, electrical and other engines, &c., and in particular to take over the British patents and part of the stock and plant of the Carding and Combing Machine Makers, Ltd. The first subscribers (each with one share):—J. Cooper, Norwood House, Ilkley, top maker; J. F. White, 15, Oak Royd Terrace, Bradford, engineer; L. Cooper, 13, Welbury Drive, Bradford, secretary; A. W. Virr, 79, St. Mary Terrace, Manningham, Bradford, manager; J. Kennedy, 83, Athol Road, Manningham, Bradford, cashier; J. Virr, Acre Villa, Eccleshill, Bradford, manager; and E. Shackleton, 75, Hartington Terrace, Bradford, mechanic. No initial public issue. Registered without articles of association. The first directors are J. Cooper and J. F. White. Registered office, Phœnix Works, Dramond Street, Bradford, Yorks.

Nelson Patent Lighting Co., Ltd. (85,908).—This company was registered on September 21st, with a capital of £2,000 in £1 shares, to adopt an agreement with J. Blakey, J. Carter and T. Rycroft, and to carry on the business of gasfitters, electricians, engineers, manufacturers of and dealers in electricity for motive power and light, &c. The first subscribers (each with one share) are:—J. Blakey, 102, Hibson Road, Nelson, ironmonger; Mrs. I. Blakey, 102, Hibson Road, Nelson; J. Carter, 13, Leeds Road, Nelson, electrical engineer; Mrs. M. A. Carter, 13, Leeds Road, Nelson; T. Rycroft, 58, Hibson Road, Nelson, plumber, &c.; Mrs. M. A. Carter, 58, Hibson Road, Nelson; and C. Thornton, 2, Leeds Road, Nelson, solicitor. No initial public issue. The number of directors is not to be less than three nor more than five; the first are not named; qualification, 100 shares.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Clarke, Steavenson & Co., Ltd. (57,821).—This company's annual return was filed on September 2nd, when the entire capital of £3,000, in £1 shares had been taken up. £1 per share had been called up on 1,400 shares, 15s. per share on 600, and 10s. per share on 1,000 shares, resulting in the receipt of £2,350. No mortgage or charges.

W. H. Allen, Son & Co, Ltd. (66,440).—This company's annual return was filed on September 5th, when 151,400 shares had been taken up out of a nominal capital of £200,000, in 200,000 shares of £1 each. £1 per share had been called up on 1,400, resulting in the receipt of £1,400, and 150,000 shares were considered as fully paid. Mortgages and charges: £55,500.

Lisbon Electric Tramways, Ltd. (62,983).—This company's annual return was filed on August 11th, when 500,000 ordinary and 425,553 preference shares had been taken up out of a nominal capital of £1,000,000, in 500,000 ordinary and 500,000 preference shares of £1 each, £925,553 being considered as paid. Mortgages and charges: £500,000 (debentures created prior to 1900).

Jandus Arc Lamp and Electric Co., Ltd. (43,898).—This company's annual return was filed on September 12th, when 2,041 shares had been taken up out of a nominal capital of £30,000, in 3,000 shares of £10 each. £5 per share had been called up on 1,195, and £10 per share on 250 shares, resulting in the receipt of £8,475, £5,960 being considered as paid on 596. Mortgages and charges: £8,000.

Malaga Electricity Co., Ltd. (48,076).—This company's annual return was filed on August 17th, when the entire capital of £57,000, in 10,000 ordinary shares of £5 each and 7,000 deferred shares of £1 each had been taken up, £5 per share had been called up on the ordinary, and £50,000 had been received, £7,000 being considered as paid on the deferred. Mortgages and charges, £44,738.

Chilian Electric Tramway and Light Co., Ltd. (57,203).—This company's annual return was filed on August 21st, when 500,000 ordinary and 600,000 preference had been taken up out of a nominal capital of £1,150,000, in 500,000 ordinary and 650,000 preference shares of £1 each, and £1 per share had been called up on the preference shares, resulting in the receipt of £600,000, the 500,000 ordinary being considered as fully paid. Mortgages and charges: £500,000.

British Prometheus Co., Ltd. (electrical cooking apparatus manufacturers, &c., Kingston), (74,889).—A second mortgage debenture for £500, dated September 12th, 1905, charged on the company's undertaking and property, present and future, including uncalled capital and book debts, has been registered. Holders: A. R. Phipps and J. R. Bedford (trading as Rashleigh, Phipps & Co.), 147, Oxford Street, W.

Electrical Bleaching Co. (1904), Ltd. (81,614).—An equitable mortgage, dated August 24th, 1905, to secure an indefinite amount, but stamped to cover £10,000, has been registered. Property charged: Messuages, tenements, mills, hereditaments, cottages, reservoirs, goits, lands, &c., with fixed plant and machinery thereon, at Tottington, Higher End, Lancs., (subject to £14,000 debts). Holders: Manchester and Liverpool District Banking Co., Ltd., Spring Gardens, Manchester.

New General Traction Co., Ltd. (47,321).—This company's annual return was filed on July 26th, when the entire capital of £370,000, in 50,000 preference and 24,000 ordinary shares of £5 each, had been taken up. £250,000 has been paid on the preference, and £120,000 is considered as paid on the ordinary. Mortgages and charges: £290,000. A memorandum of satisfaction, to the extent of £18,700, of debentures dated July 8th, 1901, securing £200,000, has been filed.

Sunbeam Lamp Co., Ltd. (25,498).—This company's annual return was filed on August 14th, when 1,765 shares had been taken up out of a nominal capital of £25,000, in 2,500 shares of £10 each. £10 per share has been called up on 908 shares, resulting in the receipt of £9,080; £8,570 is considered as paid on 857 shares. Mortgages and charges: £8,500.

Llandrindod Wells Electric Light and Power Co., Ltd. (48,340).—A debenture dated July 10th, to secure £4,000, and, as collateral security, a mortgage or even date were filed on September 18th, 1905, pursuant to order of Court. Property charged (by debenture): the company's undertaking and property, present and future. (By mortgage): Land at Llandrindod Wells, Cefnllys, Radnorshire, with buildings thereon known as the Llandrindod Wells Electric Light and Power Works, with all plant and machinery connected therewith. Holders: E. Jones, Trewythen, Llandinam; Mrs. E. Davies, Plas Dinam, Llandinam, Montgomeryshire; W. Jenkins, the Dean Collieries, Treorchy, Glam.; and G. R. Fraser, 81, Copthall Avenue, E.C.

Foster Accessories, Ltd., London (78,619).—Issue on September 4th of £100 debentures, part of series created October 9th, 1903, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holder: Mrs. E. Sparks, 99, Great Eastern Street, E.C. No trustees. Previously issued of same series: £50.

Chiswick Electricity Supply Corporation, Ltd. (38,854).—Issue on August 31st of £6,000 debentures, part of series created by resolutions of November 2nd, 1900, and March 8th, 1901, to secure £50,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. Hess, 2, Draper's Gardens, E.C. No trustees. Previously issued of same series: £38,800.

CITY NOTES.

United Electric Car Co.

Mr. George Richardson presided at this company's meeting held at the works in Preston on Thursday last week. In moving the adoption of the report, he said the directors were very happy to put before them a very much improved balance-sheet as compared with last year, when they declared a 5 per cent. dividend. They then had hopes of increasing the dividend, and he was happy to state that these had been realised. They now proposed a dividend of 8 per cent. In going over the items in the balance-sheet, he said that the patent fees came to £921, and this increase was a consequence of their taking up certain improvements for their cars. The debenture interest remained at the same figure, but £4,315 had been placed to depreciation account, this being an increase of a few pounds. The net result was that the credit balance they had was £15,188, as against £5,546. They proposed to pay 8 per cent. dividend, less income-tax; to carry £2,000 to general reserve; and to carry forward to next year the sum of £4,062. They had kept the works in proper repair, and there stood, as a reserve for depreciation, the sum of £16,500. Therefore the accounts compared very well with the previous year. The works were well known—they were not only getting better prices, but the number of cars was increasing, whilst the orders were most satisfactory. So far as they were concerned, everything was very satisfactory, and they looked forward with confidence to the future prosperity of the company. He had said nothing about the Hadley and Trafford Park Works, as this item would appear in the next balance-sheet, but the directors had no hesitation in saying that with the alterations they had made at these places everything would be satisfactory. They, however, were not prophets, but they felt that the shareholders would agree that the purchase of these works was a judicious and tradesmanlike piece of business.

Mr. John Kerr, M.P., seconded the report, which was adopted.

Mersey Railway Co.

The directors' report for the half-year ended June 30th, 1905, says that the train mileage run during the half-year was 412,215 miles, as compared with 411,683 during the corresponding six months of 1904. The number of passengers conveyed during the half-year ended June 30th, 1905, has been 4,862,378, as against 4,499,147 for the corresponding period of 1904, exclusive of season ticket holders. The total receipts from all sources for the half-year have been £43,537, as compared with £40,918 for the corresponding period of 1904. The working expenses, exclusive of the charges for pumping, ventilation and lifts, have been £30,779, equal to 70·70 per cent., as against £29,752, equal to 72·71 for the corresponding six months. These charges for pumping, ventilation and hydraulic lifts, for the past half-year amounted to £3,949, equal to 9·07 per cent., as compared with £3,839, or at the rate of 9·38 per cent. for the corresponding period of 1904. Since the closing of the accounts for the half-year the 4½ per cent. redeemable first debenture stock, amounting to £249,276, has been redeemed by the issue of 4 per cent. Mersey Railway new first perpetual debenture stock in terms of the Act of 1900, and the contract with the British Westinghouse Electric & Manufacturing Co., Ltd. A service of motor-omnibuses to and from the stations of the company in Birkenhead is being arranged for, and will shortly be inaugurated.

Willans & Robinson, Ltd.

The directors' report for the half-year ended June 30th, 1905, reads as follows:—

"The directors regret to say that the accounts for the half-year show a loss of £8,617 at Rugby, and £14,286 at Queen's Ferry, or £22,903 in all. As the provision for depreciation at the two places amounts to £17,742 and £3,929 represents the valuing down of certain stocks, the actual reduction in the liquid assets of the company, as distinct from a book loss, is £1,231. As the debit balance brought forward on the profit and loss account is £79,952, there is now a debit balance to carry forward of £102,855. The trade in high-speed engines has continued to be unprofitable, and the new classes of work taken up have not advanced far enough to produce any substantial advantage in the accounts. Of the gas engine business, it can only be said that while much expense has been incurred there is not yet sufficient evidence of a commercially profitable result to follow. As regards steam turbines, the directors are satisfied that a successful business is assured. The turbines which have been set to work have done extremely well, and this initial success will, in their opinion, lead to a rapid development of the business. The steel works at Queen's Ferry were re-started in January, and during the half-year have not only contributed to the general expenses of the business, but have yielded a small profit. The special steels made by the company are attracting increased attention, and there is a good prospect of satisfactory business in the future. The orders for boilers are sufficient to keep the remainder of the works employed upon the moderate scale to which it is at present considered advisable to limit operations. In weighing the real loss at Queen's Ferry, it is necessary not only to take into account the amount charged for depreciation and for writing down of old stocks, but the fact that Queen's Ferry is charged to the extent of nearly £3,000, with its due proportion of certain general charges, which, if Queen's Ferry were not at work, would still have to be paid. The directors are satisfied that the best policy is to continue to keep the Queen's Ferry Works open and to develop the business as opportunity serves."

Yorkshire Electric Power Co.

The half-yearly meeting was held at Ravensthorpe, Dewsbury, on Tuesday, Mr. Arthur Greenwood Lupton presided.

The report stated that the first two turbo-generators had been erected at the Thornhill Power Station, and were now working.

It was expected that the third, which would complete the present order for generating machinery, would be installed during the autumn. The equipment for sub-stations at Thornhill, Mirfield, Gomersal and Pudsey was practically completed, and now in use. From the statement of accounts, it appeared that of the authorised capital (£2,000,000), £243,218 had been paid up on June 30th. There had been expended during the half-year £78,957, making a total expenditure of £226,399.

In moving the adoption of the report and accounts, the Chairman mentioned that 1,575 shares had been issued to the Callender's Cable Co. in payment for work done. It had been necessary to organise a considerable staff to superintend the laying of the mains and the installation of the plant, and to canvass the districts which the company covered. That had entailed considerable expenditure, but it was bearing fruit in rapid development. Consumers to the extent of 900 H.P. were now connected with the mains. Agreements had been made with other consumers who would soon be connected, while negotiations were proceeding with other consumers to quite as large an amount as those already on. Mr. Woodhouse had assured the directors that the revenue for the year ending June 30th, 1906, would meet all expenditure with the exception of depreciation and interest on capital. They were now supplying three textile factories and several collieries. He believed that local authorities were beginning to realise that the company could supply electricity on a much cheaper basis than they themselves could hope to generate it. Incidentally, the chairman stated that they had paid in wages in the districts which they were serving, £50,000.

The report was adopted, and at an extraordinary general meeting which followed, the directors were authorised to borrow £80,000, and to secure the same by mortgage of the company's undertaking and by the creation and issue of debenture stock.

Mexico Electric Tramways Co.

Sir Charles Euan Smith presided at the meeting of this company on Wednesday. He said he had paid a visit to Mexico. The condition of the tramways was excellent. The cars were always well filled, and soon they would have to increase their rolling stock. They had a lottery system in connection with their tickets, which gave every passenger an interest in demanding and retaining a ticket with a view to the prizes given every month, the idea being to prevent theft by the conductors. There had been a tremendous development lately in Mexico. The Americans were pouring in large sums of money for industrial operations, and the introduction of cheap water-power had given a filip to manufacturing.

The report was adopted.

Calcutta Electric Supply Corporation. — The directors have declared an interim dividend on the paid-up share capital at the rate of 6¼ per cent. per annum for the half-year ended June 30th, payable on November 15th.

The number of units delivered to consumers during the four weeks ending August 25th, 1905, were 453,558, compared with 339,738 in the corresponding four weeks of the preceding year.

Hove Electric Lighting Co.—The directors have declared an interim dividend on the paid-up share capital at the rate of 8 per cent. per annum for the half-year ended June 30th last. The dividend is payable on October 16th next. The interim dividend for 1904 was at the rate of 3½ per cent. for the six months.

Eastern Telegraph Co.—A dividend is announced at the rate of 3½ per cent. per annum, less income-tax, on the preference stock of the company for the quarter ending September 30th, and the usual interim dividend of 1¾ per cent. on the ordinary stock, free of income-tax, in respect of profits for the quarter ended June 30th.

Stock Exchange Notices. — The Committee has appointed October 4th as a special settling day in—

Yorkshire (West Riding) Electric Tramways Co., Ltd.—£275,000 4½ per cent. first debenture stock.

And has ordered the same to be quoted in the Official List.

Kalgoorlie Electric Power and Lighting Corporation.—The interest on the 6 per cent. cumulative preferred shares accrued from the date of allotment up to December 31st, 1900, will be paid on October 18th.

Direct West India Cable Co.—The report for the year ended June 30th, 1905, submitted at the meeting on 21st, states that the net result of the year's working is a profit of £4,182, as compared with £3,617 for the previous year. An interim dividend of 3 per cent. has already been paid, and it is now proposed to made a further equal payment, which will leave £2,382 to be carried forward. This will increase the amount at credit of revenue account to £34,811.

Calcutta Tramways Co.—An interim dividend of 3s. 6d. per share on the old shares (being at the rate of 7 per cent. per annum, free of tax), on account of the profits for the half-year to June 30th, is announced.

Babcock & Wilcox.—The directors have declared an interim dividend on the ordinary shares of 1s. 7½d. per share.

Change in the Bank Rate.—The Bank rate was yesterday raised to 4 per cent.

STOCKS AND SHARES.

Wednesday evening.

Markets are drawing more public attention than they were a couple of months ago, which is something that the Stock Exchange should be thankful for. Investment departments keep a rather anxious eye upon the Bank rate, but whether the anticipated advance in the minimum will occur this week or not, these notes, written on Wednesday at the close of the Stock Exchange, find it impossible to guess. The Bank of England Court always sits on Thursday. The unpleasant sensation that there might be a rise—although the betting was two to one against a change—caused prices to remain merely steady, because it is thought that a 4 per cent. rate is practically inevitable this autumn.

Railway stocks are somewhat erratic. A point rise in Central London Deferred makes the price 80½. Assuming that the dividend of 4 per cent. will be maintained at the end of the year, as seems most probable, this Deferred stock now carries 3 per cent. interest in its quotation, its dividends being paid annually. This brings the price to really about 77½, at which the return is over 5 per cent. on the money, a good enough yield from any British railway stock. South-Eastern Deferred stands at 57, and has received nothing since 1900, with good prospects of getting the same until 1910. Districts are 35, and, as we mentioned last month, had had no dividend since 1882, while the future outlook, even Mr. Perks might hesitate to describe as brilliant from the dividend standpoint. Central London Deferred appears to be a good speculative investment to lock up.

Metropolitan Consolidated is a fraction lower at 90, and the Surplus Lands stock stands at 74. City and South London is still 41.

Four small rises in the Electric Supply section are difficult to connect with the Olympia Exhibition. County of London are again ⅛ firmer at 9, and St. James's ¼ at 14½, bringing the price level with that of Notting Hill shares. The other rises are a point each in a couple of Debenture stocks. Metropolitan Electrics have fallen back ¼ after a long, continuous rise, and the price is now 10⅜. A few dividends are announced upon electric lighting shares, the Calcutta Supply Co. declaring an interim distribution at the rate of 6¼ per cent., an improvement of the fraction as compared with the dividend a year ago. The Ordinary are 9½, and the new Ordinary 9¼. The Hove Electric is paying at the rate of 8 per cent., an increase of 1 per cent., and here the price is 8¼. River Plate Electric shares have attracted some little attention upon the issue of a good report, and the 6 per cent. Preference shares stand at a guinea, which is a couple of shillings higher than when we mentioned the investment as worth noticing. Kalgoorlie Electric Power and Lighting Preference rose to 18s. 9d. upon the announcement as to payment of arrears of interest from the date of allotment to the end of December, 1900. After this, there will yet remain nearly five years' accumulation of dividends to be paid some day, if possible.

Electric Constructions are ⅛ better at 2⅛, and the manufacturing shares, which stand some chance of benefiting from the Exhibition, are firm as a whole. This does not include Willans & Robinson, where the Ordinary are £1, and the Preference 2, all but unsaleable upon the distressing report out this week. The Debenture stock is called 74 to 79. Dick, Kerr Ordinary are 8¼, and the Preference 6¼, and by a coincidence, the Ordinary shares at 8¼ yield 6¼ per cent. on the money. The company is doing well, as we showed last week, and there are rumours that it is taking a hand in one of the new concerns formed to exploit Japanese industries. Babcock and Wilcox Ordinary are better at 3⅜, the Preference being 1½; speculation in the former has waned of late.

Notwithstanding the apparent steadiness of Anglo "A," there is a deal of gambling being transacted in the stock. The Preferred is 10s. better, but the Deferred fell a shade to 17½. This, too, in spite of prodigal market manipulation that might form the groundwork of a sensational serial story, if trade journals should run short of a plot. Western Coast of America Telegraph shares are $\frac{1}{16}$ up at 1⅛, while Direct United States shed the small amount they gained a week ago. Eastern Telegraph Ordinary lost ½, but Amazon shares improved to 3½. Movements in the Telephone group are restricted to 10s. fall in National Deferred to 108, and a diminutive rise in Oriental Ordinary to $1\frac{1}{16}$.

Further weakness manifested itself in Anglo-Argentine Tramway Ordinary, lowering the price to $8\frac{7}{16}$, and Belgrano Ordinary are also easier at 3⅜. British Electric Traction Ordinary fell ¼ to 9¼. Thefe has been a good demand for Hastings 4½ per cent. Debenture, the price rising to 101½. London United Preference are 10, and the Debenture about 101½. British Columbia Electric Deferred is 121½, and the Preferred 105½. Capes slackened to 1⅜, and at 9⅜ Calcutta Trams are without change.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last four years.				Closing Quotations Sept. 20th.	Closing Quotations Sept. 27th.	Business done week ended Sept. 27th, 1905.		Rise + or Fall —
			1902.	1903.	1904.	1905.§			Highest.	Lowest.	
34,800	African Direct Telegraph, 4 % Debs...	100	4 %	4 %	4 %	..	99—102	99 —102	..	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 - 3¼	3⅛— 3⅜	..	..	+ ⅛
119,700£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	Nil	..	82 — 87	82 — 87	..	..	..
768,580	Anglo-American Telegraph	Stock	60/6	61s.	2½%	20s.§	61 — 63	61 — 63	63	61½	..
3,118,210	Do. do. do. 6 % Pref.	Stock	6 %	6 %	5½%	58s.§	107½—108½	108 —109	108⅞	107½	+ ⅛
3,118,210	Do. do. do. Deferred	Stock	1/-	2s.	Nil	..	17⅛— 17⅜	17 — 17⅛	17⅛	16⅞	— ⅛
44,000	Chili Telephone, Nos. 1 to 44,000	5	6 %	7 %	8 %	..	7⅜— 7⅝	7⅜— 7⅝	7⅝	7⅜	..
1,992,856£	Commercial Cable Stng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	..	97 — 99	98 —100	99⅛	98½	+ 1
16,000	Cuba Telegraph	10	6¼%	10 %	5 %	..	9 — 9½	9 — 9½	..	..	..
6,000	Do. 10 % Pref.	10	10 %	5 %	10 %	..	17½— 18½	17½— 18½	..	..	..
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %§	3⅜— 3⅝	3⅜— 3⅝	..	..	..
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 %§	9½— 9¾	9½— 9¾	..	..	..
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%§	100 —103	100 —103 %	..	..	..
60,710£	Direct United States Cable	20	3½%	3 %	3½%	..	12 — 12½	11⅞— 12⅛	12⅛	12	— ⅛
74,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	..	100 —102	100 —102	..	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	5 %§	144½—147½	144 —147	146⅜	144½	— ⅛
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%§	90 — 92	90 — 92	91½	90	..
1,836,814	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	4 %	4 %§	108 —110	108 —110	109½	108½	..
300,000	Eastern Extension, Australiasia, and China Tele.	10	7 %	7 %	7 %	..	13⅞— 14⅛	13⅞— 14⅛	14⅛	13⅞	..
602,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	..	106 —108	106 —108	..	..	..
800,000	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	..	99½—101½	99½—101½	..	..	..
200,000£	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	..	101½—103½	101½—103½%	..	..	..
180,887	Globe Telegraph and Trust	10	£3 16 7*	5s½%	5s½%	..	10⅜— 11	10⅜— 11	10⅛	10⅛	..
180,887	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	14⅜— 14⅝	14⅜— 14⅝	14⅛	14⅛	..
150,000	Great Northern Telegraph, of Copenhagen	10	12½%	15 %	24 %	..	35 — 36	35 — 36	35⅜	..	..
46,560	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	..	100 —102	100 —102	..	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	13 %	..	52½— 54½	52½— 54½	54½	54½	..
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	3 %	..	..	⅜— ½	⅜— ½	..	..	..
1,983,333	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %§	112½—113½	112½—113½	113⅛	112⅝	..
1,966,667	Do. do. Def. Stock	100	4½%	5 %	5 %	5 %§	107½ 109½	107 — 109	108⅜	107	— ⅛
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %§	13½— 14½	13½— 14½	..	..	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %§	12 — 13	12 — 13	12½	..	..
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %§	5⅝— 5⅞	5⅝— 5⅞	5 9/32	5 7/32	..
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	..	99½—101½	99½—101½	..	..	..
1,689,599	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	104½—106½	104½—106½	..	..	..
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6 %	6½%	6½%	..	1⅛— 1⅜	1⅛— 1⅜	..	..	+ 1/16
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	..	1 7/16— 1 9/16	1 7/16— 1 9/16	..	..	..
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	..	100 —103	100 —103	..	..	..
11,889£	Reuter's	8	5 %	5 %	5 %	..	8 — 8½	8 — 8½	7⅞	7½	..
3,237	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	127—130	127 —130	..	..	..
58,000	United River Plate Telephone	5	7 %	8 %	8 %	..	7 — 7⅛	7 — 7⅛	..	..	..
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5⅛— 5⅜	5⅛— 5⅜	..	..	..
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	..	109½—111½	109½—111½	..	..	..
15,609£	West African Telegraph, Shares	10	2 %	4 %	4½%	..	10 — 10½	10 — 10½	..	..	..
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	Nil	Nil	..	1 1/16— 1 3/16	1 — 1	..	..	+ 1/16
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	..	100 —102	100 —102	..	..	..
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930	10	7 %	7 %	7 %	..	14 — 14½	14 — 14½	14⅝	14⅜	..
75,000	Do. do. 5 % Debs. 2nd series, 1906	100	5 %	5 %	5 %	..	101 —103	101 —103	..	..	..
563,380	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	102½—104½	102½—104½	..	..	..
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	1⅛— 1 3/16	1⅛— 1 3/16	..	..	..
34,563	Do. do. 6 % Cum. 1st Pref.	10	7 %	7 %	6 %	..	8¾— 9	8¾— 9	8⅞	..	..
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	7 — 7⅛	7 — 7⅛	..	..	..
80,000£	Do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	..	101 —104	101 —104	..	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

40,000	British Aluminium 7 % Cum. Pref.	5	Nil	Nil	Nil	..	4⅜— 5⅛	4⅜— 5⅛	5 3/32	5 1/32	..
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	Nil	Nil	..	4⅜— 5⅛	4⅜— 5⅛	..	..	..
20,000	Do. do. 4 % Funding Certs.	5	..	..	..	..	2⅞— 3⅛	2⅞— 3⅛	..	..	..
800,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	99 —103	99 —103	..	..	..
133,301	British Electric Traction	10	8 %	6 %	6 %	..	9⅛— 9⅜	9 — 9⅛	9⅜	9⅛	— ⅛
156,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	10⅜— 11	10⅛— 11	10⅝	10⅜	..
1,000,000£	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	..	123 —125	123 —125	124⅜	121⅛	..
250,000	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	..	4½%	..	99 — 101	99 —101	99⅞	99⅝	..
100,000	British Insulated and Helsby Cables	5	10 %	8 %	8 %	8 %§	5⅞— 6⅛	5⅞— 6⅛	..	..	..
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %§	5⅞— 6⅛	5⅞— 6⅛	5⅞	..	..
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%§	103 —106	103 —106	103¼	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅞— 1 1/16	⅞— 1 1/16	..	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	Nil	Nil	..	⅜— ⅝	⅜— ⅝	..	..	..
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..
125,000£	Do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	..	91 — 94	91 — 94	..	..	..
125,000£	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	..	78 — 81	78 — 81	..	..	..
35,000	Callender's Cable Construction shares	5	15 %	12½%	12½%	..	10 — 11	10 — 11	..	..	..
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅜— 5⅝	5⅜— 5⅝	..	..	..
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	..	109 —111	109 —111	..	..	..
1,963,208	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %§	90 — 92	90 — 92	91	..	..
523,396	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %§	101 —103	101 —103	102½	..	..
523,396	Do. do. Def. do.	Stock	4 %	4 %	4 %	..	78 — 81	82 — 85	80½	80	+4
1,330,000	City and South London Railway	Stock	3½%	2¾%	2½%	2 %§	40 — 42	40 — 42	..	..	..
85,000	Crompton & Co., Nos. 1 to 85,000	3	5 %	2½%	2½%	..	1⅜— 1⅝	1⅜— 1⅝	1 13/32	..	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	..	95 —100 %	95 —100%	97	..	..
99,261	Edison & Swan Utd., "A" shrs., £3 pd., 1 to 99,261	5	Nil	Nil	..	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..
17,139	Do. "A" shares, 01—017,139	5	Nil	Nil	..	..	2 — 2½	2 — 2½	..	..	..
944,923£	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	83 — 88	83 — 88	..	..	..
100,000£	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	89 — 94	89 — 94	..	..	..
112,100	Electric Construction 1 to 112,100	2	6 %	4 %	Nil	..	⅝— 1	⅝— 1	..	..	..
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	..	1⅛— 2⅛	1⅛— 2⅛	..	..	+ ⅛
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Sk.	Stock	4 %	4 %	4 %	..	92 — 95	92 — 95	..	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	9½— 10	9½— 10	..	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	..	97 —101	97 —101	..	..	..
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	20 %	15 %	15 %	10%§	12 — 13	12 — 13	..	..	..
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	..	5⅛— 5⅜	5⅛— 5⅜	5⅜	..	..
45,900	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	..	109 —111	109 —111	..	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works..	10	10 %	10 %	5 %	2½%§	15⅛— 16⅛	15⅛— 16⅛	15⅝	..	..
800,000£	Do. do. 4% 1st Mort. Deb.	100	4 %	4 %	4 %	..	100 —103	99 —102 xd	..	..	— ⅛
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	1½%	1½%	..	2⅜— 2⅞	2⅜— 2⅞	..	..	..
10,000	Do. do. Pref. £10 paid	10	5 %	5 %	5 %	5 %§	9 — 9½	9 — 9½	..	..	..
37,350	Telegraph Construction and Maintenance	12	20 %	20 %	15 %	..	33¾— 35½	33¾— 35½	33½	..	..
150,000£	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	..	102 —104	102 —104	..	..	..
540,000£	Waterloo & City Railway, Ord. Stock	100	3½%	3½%	3½%	3 %§	90 — 92	90 — 92	..	..	..

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § Interim dividends.
¶ From Manchester Share List.

Bank rate of discount 3 per cent. (September 7th, 1905).

SHARE LIST OF ELECTRICAL COMPANIES *(continued)*.—ELECTRICITY SUPPLY COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1902.	1903.	1904.	§1905.	Closing Quotations Sept. 20th.	Closing Quotations Sept. 27th.	Business done week ended Sept. 27th, 1905. Highest	Lowest.	Rise + or Fall −
		†									
29,377	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	8 %	10 %	10 %	..	9¾ — 10¼	9¾ — 10¼	..	..	..
10,623	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	9⅝ — 10⅛	9⅝ — 10⅛	..	..	..
288,782	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	..	103 —106	103 —106	104	..	..
80,000	Charing Cross and Strand Electricity Supply ..	5	10 %	8 %	8 %	5 %§	6¾ — 7¼	6¾ — 7¼	..	..	..
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	..	5⅛ — 5⅝	5⅛ — 5⅝	5⅛	..	..
40,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	..	4¾ — 5	4¾ — 5	..	..	..
40,000	Do. do. 1903	5	..	4½%	4½%	..	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..
350,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	..	103 —105	103 —105	104¼	104	..
44,436	Chelsea Electricity Supply, Ord.	5	4½%	5½%	6 %	4½%§	5⅝ — 6⅛ xd	5⅝ — 6⅛	..	..	..
150,000£	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%§	108 —110	109 —111	..	..	+1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	5 %	6 %	..	11 — 11¼	11 — 11¼	11⅜	11⅛	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	..	13 — 14	13 — 14	..	..	..
400,000£	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	..	124 —128	124 —128	..	..	..
300,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	..	104 —106	104 —106	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4 %	4½%	4 %§	8⅝ — 9¼	8⅝ — 9¼	..	..	+ ⅛
90,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	12 — 12½	12 — 12½	12⅛	..	..
400,000£	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	..	111 —114	111 —114	112⅝	112¼	..
250,000	Do. do. 4½ % 2nd Deb. Stock ..	Stock	4½%	4½%	4½%	..	103 —105	103 —105	103½	..	..
70,000	Edmundson's Electric Corporation, Ord. Shares ..	5	7 %	7 %	7 %	..	5⅞ — 6¼	5⅞ — 6¼	..	..	..
80,000	Do. do. 6 % Cum. Pref..	..	6 %	6 %	6 %	..	6⅛ — 6⅜	6⅛ — 6⅜	6⅜	6⅛	..
300,000£	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	..	106 —108	107 —109	108	107½	+1
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	12 %	12 %	..	12 — 12⅜	12 — 12⅜	..	..	..
136,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	..	97 —100	97 —100	..	..	..
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	Nil	3 %	..	2 — 2⅛	2 — 2⅛	..	..	..
60,000	Do. do. do. 6 % Pref..	5	6 %	6 %	6 %	..	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..
371,895	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	..	99 —102	99 —102	100¼	..	..
100,000	Metropolitan Electric Supply, 1 to 100,000	5	7½%	8½%	10 %	10%§	10⅞ — 11¼	10⅞ — 11	11	10⅞	— ¼
76,121	Do. 4½ % Cum. Pref. 1—71,106, £3 pd.	5	4½%	4½%	4½%	..	5⅝ — 5⅞	5⅝ — 5⅞	5⅞	..	..
220,000£	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	..	109 —113	109 —113	..	..	..
250,000£	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	..	100 —102	100 —102	..	..	..
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	..	100 —102%	100 —102%	101⅛	101	..
10,852	Notting Hill Electric Lighting	10	6 %	6 %	7 %	..	14 — 15	14 — 15	..	..	..
59,000	Do. do. 4 % 1st Mort. Deb.. ..	100	4 %	4 %	4 %	..	100 —102	100 —102	..	..	..
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	14½%	14½%	14½%	10%§	13⅝ — 14⅞	14 — 15	14⅝	14⅜	+ ½
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %§	8 — 9	8 — 9	..	..	..
150,000£	Do. do. 3½ % Deb. Stock Red. ..	100	3½%	3½%	3½%	..	98 —100	98 —100	..	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	2½%	4 %	4 %	..	2¼ — 2⅜	2¼ — 2⅜	..	..	..
50,000	Do. do do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	..	76 — 80	76 — 80	..	..	..
65,000	South London Electricity Supply, Ord.	5	12½%	3 %	4 %	..	3¾ — 4	3¾ — 4	3⅞	..	..
100,000	South Met. Elec. Lt. & Power (Ord..	1	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	⅛	..	..
50,000	*(Late Blackheath and Greenwich* (7 % Pref.. ..	1	Nil	7 %	7 %	..	1⅛ — 1⅛	1⅛ — 1⅛	..	..	..
100,000	*Dist. E.L.Co.)* (4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	..	106 —109	106 —109	..	..	..
30,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	4⅜ — 5	4⅜ — 5	4⅜	4⅜	..
30,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	5⅛	..	..
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	..	4½%	..	105 —107	105 —107	106	..	..
110,000	Westminster Electric Supply, Ord.	5	12 %	15½%	14 %	13%§	12⅜ — 13⅛	12⅜ — 13⅛	13	12⅝	..
28,151	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	6⅛ — 6⅜	6⅛ — 6⅜	6⅜	..	..

Shares not officially quoted :—Mackay Companies, ord., 43⅜—44. Pref. 76½—77.

† Unless otherwise stated all shares are fully paid. § Interim dividends.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	£*	No. of wks.	Total to date. £	£*	Route miles open.	*
Aberdeen	Sep. 23	2,883	— 25	17	26,378	— 1,451	..	..
Ayr	,, 16	574	— 511	18	7,204	— 581	8	..
Bath	,, 20	1,635	+ 69	38	26,171	+ 1,528	13	..
Birkenhead	,, 24	2,067	— 73	25	27,103	— 493	13·5	..
Blackburn	,, 20	2,077	+ 29	25½	25,991	+ 741	14·25	..
Blackpool Corp.	,, 21	3,435	— 362	25	38,652	+ 2,150	11·87	..
,, —Fleetw'd	,, 23	2,097	— 58	12	16,488	— 902	..	..
,, —Lytham	June 22	1,602	+ 753	34	7,608	..	7½	..
Bolton ..	Sep. 24	3,931	+ 114	26	51,140	+ 1,759	26	+ 1
Bournemouth ..	,, 20	3,533	+ 928	..	..	..	13·91	+ 3½
Bradford	,, 23	9,100	— 538	25	114,664	— 5,792	48	..
Brighton	,, 24	2,274	..	26	29,295	..	9·5	..
Bristol	,, 22	10,067	— 330	..	..	..	28·5	..
Brit. Elec. Trac. Co.								
Airdrie	Sep. 15	467	+ 49	37	7,512	+ 74	8·5	..
Barnsley	,, 15	308	— 35	,,	6,005	— 245	3	..
Barrow	,, 15	542	+ 56	,,	9,112	+ 1,976	5·37	..
‡Birmingham (City)	,, 15	10,266	— 229	,,	200,946	+ 3,291	14·5	..
Birmingham (Mid.)	,, 15	3,076	— 518	,,	60,573	+ 1,521	12·25	..
Devonport ..	,, 15	957	— 219	,,	17,310	— 2,645	8·85	..
Dudley—Sto'rb'ge	,, 15	1,968	+ 38	,,	33,882	+ 1,354	21·25	..
Gateshead	,, 15	1,909	+ 44	,,	33,964	+ 645	11·25	..
Gravesend, N'fleet	,, 15	535	— 37	,,	8,741	— 989	6·5	..
Gr'n'k, Pt. Glsgw	,, 15	1,440	— 54	,,	23,949	+ 2,502	7·25	..
Hartlepool ..	,, 15	589	— 40	,,	9,959	— 1,125	6·72	..
Kidderminster ..	,, 15	276	— 17	,,	4,676	— 267	4·5	..
Leamington ..	,, 15	306	+ 122	9	2,125	+ 935	..	..
Merthyr	,, 15	385	— 32	37	7,093	— 374	2·9	..
‡Metropolitan ..	,, 15	6,638	+2,537	,,	98,264	+44,320	..	..
Middleton.. ..	,, 15	597	— 66	,,	12,888	+ 536	8·5	..
Oldham — Ashton	,, 15	1,122	+ 11	,,	20,631	+ 295	9·13	..
Peterborough ..	,, 15	301	— 39	,,	5,246	— 478	5·31	..
Potteries	,, 15	3,513	— 4	,,	62,463	+ 319	29	..
Rothesay	,, 15	492	+ 164	,,	8,429	+ 2,397	2·75	..
Sheerness	,, 13	170	+ 11	,,	2,715	+ 310	2·5	..
Southport	,, 15	589	— 24	,,	12,127	+ 969	8·17	..
South Staffs. ..	,, 15	1,570	+ 215	,,	26,787	+ 508	13·87	..
Swansea	,, 15	1,745	+ 641	,,	46,253	+ 5,855	5·5	..
†Taunton	,, 8	57	— 3	,,	1,851	— 191	1·5	..
Tynemouth ..	,, 15	584	— 59	,,	10,237	— 1,063	3·75	..
Weston-s-Mare ..	,, 13	553	+ 72	,,	5,993	+ 596	3	..
Wolverhampton D.	,, 15	958	+ 56	,,	14,579	+ 56	14·75	..
‡Worcester	,, 15	742	+ 25	,,	11,582	+ 630	5·75	..
Wrexham	,, 15	238	— 17	,,	3,811	— 955	4	..
Yorks. Wool. Dist.	,, 15	1,401	+ 84	,,	24,153	+ 2,005	17	..
Burnley	Sep. 23	2,329	+ 213	..	..	..	7·5	..
Burton-on-Trent ..	,, 24	609	— 102	25	8,424	— 1,015	8·5	..
Bury	,, 17	1,512	..	24	18,315	..	10·5	..
Cardiff	,, 16	4,071	—180	24	52,254	+ 211	15·8	..
Carlisle	,, 23	585	— 45	38	7,148	— 497	..	..
Chatham and Dist.	Sep. 21	1,421	+ 152	38	25,615	+ 2,895	9·3	+ ·8
Colchester	,, 20	443	— 164	8	2,024	..	7	..
Cork	,, 21	1,020	— 29	38	18,780	+ 769	9·69	..
Darlington	,, 23	403	+ 16	25	5,266	..	4·87	..
Darwen	,, 22	515	+ 23	25	6,241	+ 273	4·36	..
†Dover	Aug. 12	344	+ 27	32	6,651	— 268	3·5	..
Dublin	Sep. 22	9,736	— 366	..	66,204	— 402	48·5	+ 1·5
Dundee	,, 20	2,048	+ 313	18	16,483	..	..	..
East Ham	,, 23	1,715	+ 279	25	21,826	+ 2,109	6·75	..
Glasgow	,, 23	31,889	+1,131	16	253,358	+11,960	76	+ 4·5
†Gloucester	,, 20	299	— 43	24	8,006	..	15	..
†Halifax	,, 13	2,995	— 126	24½	40,219	+ 1,578	37	+ 4
Huddersfield ..	,, 23	2,821	+ 185	25	34,720	+ 807	..	..
Hull	,, 23	4,314	+ 21	25	55,730	+ 509	13	..
Ilford	,, 23	968	+ 54	26	12,899	+ 27	..	..
Ilkeston	,, 20	236	— 53	25	3,120	— 667	3·5	..
Ipswich	,, 23	969	— 91	25	12,292	— 1,495	10·5	..
Isle of Thanet ..	,, 23	1,859	— 204	38	27,460	— 2,734	..	..
Kirkcaldy	,, 20	438	— 43	..	..	..	7·5	..
Lan'kshire Trm. Co.	,, 21	1,833	+ 343	38	27,543	+ 3,057	12·5	+ 3·9
Leeds	,, 23	12,091	+ 168	25	157,752	+ 3,181	89·5	+ 8
Leicester	,, 23	4,210	..	38	79,463	..	..	..
Liverpool	,, 16	21,672	+ 371	37	393,020	+ 9,026	104	+ 1
L.C.C.	,, 9	29,556	+2,070	23	353,175	+56,960	51½	+ 4·6
Lowestoft	,, 23	564	+ 29	51	10,121	..	3·5	..
Manchester	,, 23	25,781	+ 477	26	330,943	+14,624	..	..
Newcastle	,, 23	7,526	+ 204	25	97,299	+ 3,046	..	..
Newport	,, 23	1,189	+ 167	25	15,496	+ 2,234	14·5	+ 1·5
Oldham	,, 24	3,328	+ 952	26	43,331	+11,718	23·75	..
Plymouth	.. ..	..	..	..	..	..	..	..
Pontypridd	,, 23	305	..	25	4,224	..	3·5	..
Portsmouth	,, 23	4,276	+ 78	25	57,684	+ 1,702	..	..
†Reading	,, 4	563	— 3	25	16,656	— 903	..	..
Rochdale	,, 23	1,716	+1,174	25	19,668	+15,237	21·3	..
Salford	,, 18	8,414	+ 83	24	108,977	+ 6,415	..	..
†Scarborough ..	,, 16	267	..	37	6,937	..	4·5	..
Sheffield	,, 24	9,912	+ 652	26	129,798	+ 5,843	35·75	−1·5
†Southampton ..	,, 13	1,028	— 80	24	24,725	— 511	..	..
Southend-on-Sea ..	July 26	1,089	+ 67	17	6,596	+ 468	6·25	..
†Stalyb'dge,Hyde,&c.	Sep. 16	673	+ 158	24	16,164	..	21	..
†Stockport	,, 15	706	+ 234	..	..	..	14·5	+ 3·5
Sunderland	,, 24	2,668	+ 142	24	35,140	+ 940	..	..
†Swindon	,, 26	206	..	25	5,185	..	..	..
Tyneside	,, 20	814	— 78	38	16,055	+ 1,143	8·87	..
†Warrington	,, 14	345	+ 18	24	8,291	+ 400	6·37	+ ·25
West Ham	,, 21	4,254	+1,903	25	44,145	+18,184	13·25	+ 4·5
Wolverhampton ..	,, 20	1,676	+ 168	24	20,753	..	10	..
Cen. London Rly.	Sep. 23	12,156	— 328	12	68,772	— 1,774	6	..
City & S. Lon. Rly.	,, 24	4,998	— 226	12	27,858	— 558	6·25	..
Dublin-Lucan Rly.	,, 22	379	+ 9	12	1,797	+ 40	7	..
G. N. and City Rly.	,, 23	2,983	+ 615	12	17,268	+ 4,668	3·5	..
L'pool Overh'd Rly.	,, 24	2,970	— 120	..	20,935	— 639	..	..
Mersey Railway ..	,, 23	2,165	+ 201	12	18,585	+ 1,238	4·5	..

* Compared with the corresponding period of 1904. † One week only. ‡ Includes horse and other receipts.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1905.

The returns of the August exports of electrical goods and material do not present a very favourable index to our trade; the value having dropped from £128,560 in July to only some £98,362 in the month in question.

This decline is particularly noticable in the leading items, machinery and cable exports alone showing a decline of some £22,000 in value.

On the other hand, the total of the imports is some £9,000 more than in the previous month, amounting to £115,949; the increase being apparent in miscellaneous goods and telephone material, and it is some consolation to find that cable and machinery imports, as well as exports, show somewhat reduced values.

During the month no exports or imports of electric tramway material were recorded, and our only recorded telegraph export was of wireless apparatus to China.

No particular changes are shown in the prominent purchasing and importing countries.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Electric light and power cable.	Electric lighting fittings and accessories.	Electric lamps.	Electric meters and instruments.	Electric machinery.	Batteries and accumulators.	Carbons.	Telephone material and electric bells.	Electrically-driven machinery.
	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,241	17	64	20	25	871	35	...	1,091	...
Germany	364	...	2	29	472	377	50	...	257	...
Netherlands	206	150	231	...	...	79	...	...	78	...
Dutch Borneo and Indian Possessions	134	...	5	...	...	190	...	...	...	...
Belgium	105	...	9	...	...	...	69	...	35	...
France	538	7	172	22	10	524	64	...	...	19
French Indo-China	...	...	7	64	...	...	...	...	...	...
Portugal, Madeira, and Portuguese Africa ...	19	410	93	281	763	809	...	...	130	...
Spain and Canary Isles	170	5	106	...	6	262	...	...	...	2,000
Italy and Austria-Hungary	...	...	...	29	...	218	45	...	...	56
Greece, Bulgaria and Roumania	3	...	...	107	...	244	...	...	...	...
Egypt	303	40	...	10	150	168	10	...	27	...
China and Siam	292	25	468	80	480	593	196	...	...	...
Japan	48	1,480	...	...	53	1,025	...	...	547	773
U.S.A., Philippines and Cuba	6	645	85	15	161	40	52	...	...	...
Mexico Colombia, Panama, Peru and Uruguay	64	69	13	...	...	1,460	11	...	...	...
Chili	...	...	27	53	...	916	4	...	...	...
Brazil	471	1	...	265	23	1,512	683	...	...	...
Argentine	281	459	786	40	...	2,889	15	...	180	110
Channel Isles, Gibraltar, Malta and Cyprus ...	1,497	78	49	...	29	317	...	...	107	...
British West Africa	...	...	10	...	13	137	...	...	...	...
Cape of Good Hope	1,166	4,623	422	327	291	1,080	60	...	313	979
Natal	962	311	1,120	238	951	4,079	81	22	75	150
Zanzibar, Brit. East Africa, Mauritius and Aden	68	...	...	3	...	150	87	...	120	...
India	2,138	2,366	1,452	814	670	9,172	44	563	80	873
Burmah	92	...	82	18	...	3	...	16	...	...
Ceylon	27	...	216	5	...	...	15	...	29	...
Straits Settlements	450	1,929	257	23	7	1,102	2	2	477	76
Hong Kong	93	2,745	124	12	...	60	13	...	7	74
West Australia	619	1,016	234	185	...	291	3	...	46	...
South Australia	35	33	162	28	41	176	4	...	7	...
Victoria	543	101	...	246	90	1,518	19	...	28	...
New South Wales	1,580	962	78	516	77	1,330	8	...	978	...
Queensland	1,404	...	...	...	...	261	...	...	...	...
New Zealand	406	2,926	367	41	33	349	340	...	1,717	69
Canada	19	...	83	8	...	321	...	...	...	12
British West Indies and British Guiana ...	76	10	240	33	...	134	13	5	25	...
Total, £	15,410	20,408	6,964	3,512	4,335	32,657	1,923	608	6,354	5,191

Note.—No exports or imports of tramway apparatus or material, specified as such.

Additional exports: China, wireless telegraph material, £1,000.

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	
Norway, Sweden and Denmark	172	75	...	237	...	727	277	...	9,731	...	...
Germany	6,877	9,272	515	120	...	8,117	1,363	123	1,645	...	...
Holland	6,912	312	1,340	48	40	513	...	3,126	...	...	...
Belgium	12,223	970	...	1,173	80	11,448	322	987	1,450	...	...
France	6,328	272	235	139	1,080	2,232	357	2,469	...	...	...
Austria-Hungary	3	...	...	...	...	141	...	...	...	...	...
United States	6,837	...	231	306	196	14,175	55	192	8	496	...
Total, £	39,352	10,901	2,321	2,023	1,396	37,353	2,374	6,897	12,834	496	

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	
Various countries, mainly as above	1,626	589	113	...	50	2,909	3	183	675	...	...

Total Exports: £98,362

Total Re-Exports: £6,148

Total Imports: £115,949

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

UP-TO-DATE ELECTRICAL POWER DISTRIBUTION.*

By R. L. GAMLEN.

It is now about 28 years since electricity was first generated commercially. With Mr. J. W. Swan's discovery of the carbon filament the incandescent lamp offered at once a solution of the problem of internal lighting. Not long afterwards, the first early attempts were made at electric traction.

Developments soon came which not only made the working for lighting better, but also made the supply of power a possibility.

The immense value of a power load became at once apparent to supply engineers, as here was a chance of increasing their working hours of utility, and they at once started to put their works in order so as to profit as far as possible by this new source of revenue and to cater for it to the best of their ability. They have succeeded to a great extent, but the old system had its limits, and great power companies have sprung up to deal with the question. Not as a patchwork of old methods, but starting *de novo*, and on lines designed for the particular work, with none of the old unnecessary drawbacks, but with all experience at their back.

A demand has now come for:—(1) Electricity to be supplied more cheaply than it can be made by individuals; (2) a supply so certain that, but for a veritable "act of God," no cessation can occur; and (3) a supply so regular that the angular velocity of the motors is more constant than the best results before obtained.

In the records of electricity concerns, a capital of £100 per KW. of plant is no uncommon figure; but a quarter of this figure should be obtained by a power company. The factors controlling the choice of plant are:—Absolute immunity from breakdown, perfect regulation, small fuel consumption, ease of working, and consequently a low wages bill.

The example of how these and other requirements have been attained in the Lancashire Power Co. may be the most convenient because it is up-to-date and of as neat design as any in the country.

The power companies have in nearly all cases laid out their schemes on somewhat similar lines. Three-phase distribution has been adopted, at a pressure generally of about 10,000 volts. The current has been generated at high pressure, generally by means of turbines running with high vacuum and high superheat. The water-tube boiler has been universally adopted, and one or another form of mechanical stoker used.

In the case of Lancashire, the first station has been placed between the River Irwell and the railway, upon the far side of which is a coal mine, from which supplies can be obtained. The site is convenient, inasmuch as there is an ample water supply for condensing purposes; the railway being situated above the boiler house, the coal is conveyed by gravity into the bunkers, and thence it is fed on to chain-grate stokers, operated by electric motors. The first boiler house is divided into two banks of three boilers. The two banks are each capable of evaporating 60,000 lb. of water per hour. The boilers feed on to one common ring of pipes, and the turbines are fed from the same, so that two turbines are fed from one bank. One bank of boilers then, with its chimney and two turbines, constitutes 1 unit. It is proposed to make extensions in like manner, except that instead of one bank of boilers feeding two turbines, each bank will feed one machine of larger capacity. The water-tube boiler is used on account of the very great steaming capacity for a given floor space, and of its great powers of responding to forcing. It is, of course, highly important when dealing with large generators to arrange that sufficient boiler capacity can be available without the steam having to travel through vast lengths of main. By placing the boilers at right angles to the turbines, very satisfactory arrangements can be arrived at.

The turbines revolving at 1,000 r.p.m. look, of course, exceedingly small for the amount of work they do; indeed, the amount of power that can be obtained on a certain floor space by their means seems nearly incredible to the engineer who has been accustomed to work with the older slow-speed engines. The turbine lends itself particularly well for condensing; in the case of the Curtis turbine there is no exhaust pipe, the condenser being coupled direct to the engine. This can be done in two ways: either by placing the condenser side by side with the turbine, or underneath, either arrangement being very compact and convenient. In Lancashire the air-pump is placed beyond the condenser, so that the three form really one plant. The result is that an engine room only 96 ft. long and 32 ft. wide is needed to house four sets of 2,000 KW. each, or 8,000 KW. in all; whereas in nearly all previous cases as large a building has been necessary for an engine of 800 H.P. and less. When the extensions take place, this ratio of plant and buildings will diminish again, as the diameter of the 5,000-KW. set is comparatively little larger than that of the 2,000-KW. plant. In the case of the Curtis combination, the dynamo is placed on the same spindle as the driving buckets and vertically above them. Owing to the high speed of rotation the electrical generator is of very small proportions, the diameter being only some 7 ft.; whereas an ordinary direct-coupled set, at about 150 r.p.m., would be somewhere about 25 to 30 ft. high, and, of course, much more expensive.

The three-phase current generated at the high pressure of 10,000 volts is carried to the switchboards. A great deal depends upon the design of this section. The operation must be easy, there must be no danger from fire, and the whole must be safe. The system known as remote control has been employed almost universally. The danger of switchboard trouble is overcome; no mains of large power are on the operating board, so that there is nothing to fire; and even if any little accident did happen it would not damage the main cables, as they are not near, and the supply would not suffer. Here, again, the simplicity is such that one man can look after and control what would before have needed perhaps five or six men.

By being able to spread over large areas, great varieties of load can be catered for, and these different requirements balance out one with another, giving a very constant load at the station. It is likely that the number of units produced by a power company when attaining to moderate size for each kilowatt demanded should reach 2½ times that of the ordinary town supply—that is, the load-factor of an ordinary combined lighting and power supply will be high at 18 per cent., while that of the power company should reach 45 per cent., and this greatly reduces all the annual capital charges.

There is great prejudice in this country against the use of overhead mains, but this is gradually being overcome, and already great advances are being made. In the original scheme, the whole of the Lancashire mains were intended to run underground; already it has been arranged that some 10 miles of route shall be overhead. By this means, expensive insulation is saved, and also the excavation and reinstatement of the roads, greatly reducing the cost of the transmission system. Further reduction is obtained also, as often the cross-country overhead route is much shorter than if the roads had to be followed. The main routes are laid in duplicate, and are planned to go through the most likely districts for supply.

Arrangements are made with the various local authorities for the supply in their areas. In some cases, the current is sold to the authorities, and they distribute to the small consumers at low pressure; in other cases, the company act more or less as agents for them and look after the distribution. In all cases, large power users are served direct from the high-tension mains. In most cases, the current used is three-phase, as this is most suitable for almost all purposes; the reduction apparatus in this case has no moving parts and requires no attendance, so that even in this extra stage to that needed by the ordinary supply concern no extra expense is incurred.

The following points indicate the general scheme of the lay-out of the power company, and show where the differences occur between it and the ordinary town supply:—(1) The power company chooses its site near the fuel and the water; (2) The power company spreads out over a large area, and caters for a large long hours' load, consequently it can start on large lines with large units of plant, the capital cost of plant per horse-power diminishing as the size increases; (3) The load factor of the power company should reach 45 per cent., and (4) all the working expenses of the power company per unit are extremely small on account of the size and convenience of the units. On the other hand:—(1) The town supply is located by the area of supply, and it seldom can be placed near water, and hardly ever near a coal-pit; (2) The town supply has a constricted area, and can only work in small units, and small units are more costly per horse-power than large ones; (3) A good mixed town supply can hardly ever have a better load-factor than 18 per cent.; and (4) the wages bill of a town supply is generally a large factor of the total costs.

The preceding recited points show that power companies hope to be able to supply electricity far more cheaply than town undertakings, and the future will show whether their ideas are based on fact or on fiction.

* Abstract of paper read before the Institution of Mining Engineers.

ELECTRICITY IN AMERICAN MINES.

By T. CAMPBELL FUTERS.

The introduction of machinery into mines is probably much more advanced in America than in our own country, as coal-cutting machinery, for instance, was already established there at the time when it was beginning to be introduced into the mines here. This, however, is not to say that coal-cutting machinery is an American invention, as coal-cutting machines were known in this country as far back as 1761, when a Mr. Menzies, of Newcastle-upon-Tyne, took out a patent for a machine to cut coal, and since that time a host of other inventors have brought out different machines, none of which, however, for various reasons "took on." With characteristic American energy, however, the coal-cutting machine was taken up, and may be said to have been developed by our cousins, and proved to be commercially successful. The underground locomotive, also, has met with much more success in American collieries than here, but this is mainly due to somewhat different conditions.

The machinery underground up to very recently was practically solely driven by compressed air, and the substitution of electricity has probably met with more opposition in America than in our own country, where compressed air-driven machinery was not so much in use.

The New York *Electrical Review* for April 8th and 15th, 1905, contains an interesting article describing the introduction of electricity into the anthracite coal mines near Scranton, Pa., where compressed air and steam-driven machinery is gradually being displaced by electrically-driven plant. Both continuous current and alternating current systems are in use, the latter having the advantage when the transmission has to be made over some distance, though where electric locomotives are installed the alternating current is converted into continuous.

At the Jermyn Colliery, belonging to the Delaware and Hudson Canal Co., who operate a number of mines in the district, electricity is just being introduced. The pit is about 200 ft. deep, and the workings extend 1 mile or more from the shaft. The coal is hauled up inclined planes by steam engines, two being located in the pit and another at the surface. At the foot of the shaft a small steam-driven chain haul is used to carry the empty tubs up a short incline from the foot of the shaft; the engine is to be replaced by an electric motor of 7½ H.P. running at 815 r.p.m., which will be geared to the chain haul. The generating plant is in the same house as the hauling engine, and consists of an eight-pole 180-KW. 300-volt direct-current generator coupled direct to a 243-H.P. engine running at 250 r.p.m.; this furnishes current for lights in the mine and breaker (heapstead), and for operating three electric locomotives in the mine.

The switchboard consists simply of oak uprights carrying a number of oak slabs, to which the various instruments are secured, which is very different to the practice in this country. A lightning arrester is inserted in the power line just after it leaves the switchboard. The power line consists of two cables, only one of which is insulated; the other is *bare*, and is earthed immediately after leaving the power house. It is interesting to compare this method of fixing cables with the practice here—now insisted upon by the law—of having both cables thoroughly insulated and protected.

Two of the electric locomotives in the mine are used for shifting the tubs from the main roads to the various workings. These locomotives are small, weighing about 5 tons each, and have a draw-bar pull of 1,200 lb. The third locomotive is considerably larger, weighing 13 tons; it is 12 ft. long × 4 ft. wide, and about 3 ft. 6 in. high from the rail. It carries two 50-H.P. motors geared directly to the axles, and runs on 33-in. diameter wheels, the gauge being 28 in. Its speed is about 8 miles per hour, and it has a draw-bar pull of 4,500 lb. The head lights are 32-C.P. lamps set in parabolic reflectors. Current is taken from an overhead wire by means of a trolley. The wire is suspended from double-petticoated insulators attached directly to the roof of the mine by a casting. The return circuit is through the track and ground, hence the reason for earthing one cable. This locomotive hauls the tubs from a point where they are gathered by the small ones to the foot of the inclined planes, whence they are hauled by rope by the steam-hauling engines to the shaft. The two small locomotives run further into the workings than the trolley wire does. When they reach the end of the wire the trolley is unshipped, and a cable carried on a reel on the locomotive is attached to the trolley wire. The locomotive is then enabled to go about 1,000 ft. beyond the end of the trolley wire. The reel is connected by a chain and sprockets to one axle of the locomotive, and winds or unwinds the cable, according to the direction of the locomotive.

Previously to the introduction of these locomotives, the tubs in the mine were moved by mules, of which 55 were engaged in shifting and moving the tubs or cars to and from the rope hauls. Under the most favourable conditions the mules could haul about three loaded cars, each holding between 2 and 3 tons of coal. The best speed that could be obtained was not over 2½ miles per hour. Each mule required a driver, whereas the 13-ton locomotive alone can haul a train of 30 loaded tubs at a speed of 8 miles per hour, and is operated by one man, so that the saving in labour alone due to the locomotives is considerable. It is also interesting to note that a (fireless) steam locomotive was used for some time prior to the installation of the electric locomotive, but was very unsatisfactory, on account of the exhaust steam and waste gases. Much time is also saved in switching the tubs, the tubs and locomotives being coupled and uncoupled much more quickly than was possible with the mules.

At another colliery—Coal Brook—owned by the same company, compressed-air locomotives are in use. A sufficient proof of the superiority of the electric locomotives is given when it is stated that it is contemplated to adopt the latter in place of the former. To quote the article: "It is anticipated that these will have many advantages over the compressed-air locomotives now in use, as there is considerable annoyance caused, and much time lost in charging the compressed-air locomotives, which also give trouble by freezing."

The electric installation at this colliery consists of a 150-KW. three-phase, 60-cycle, 2,300-volt alternating current generator running at 1,600 r.p.m., driven from a steam engine by belt. The exciter is belted to the generator shaft. This plant furnishes current to operate a number of fans in the mine. Another belt-driven generator furnishes current for lighting. This also is a 2,300-volt three-phase, 60-cycle machine of 300 KW. capacity, driven by a 400-H.P. engine running at 80 r.p.m. The exciter is also belted to the generator shaft. The switchboard is of grey marble, and has 10 panels. In the rear of the switchboard are installed two constant-current transformers for the arc lights, these being 34-KW. 60-cycle machines and operating with a primary voltage of 2,200, giving a secondary current of 7·5 amperes.

The ventilating fans are driven by induction motors, the 10-ft. and 17-ft. fans being driven by 20 and 40-H.P. motors respectively at a pressure of 220 volts, obtained from oil-cooled transformers. A 20-ft. diameter fan is driven by a 50-H.P. induction motor which operates at 2,200 volts directly from the line, a much better way than having to introduce transformers to lower the voltage.

Another company—the Delaware, Lackawanna and Western Railroad Co.—who own about 15 collieries in the same district, have extensively adopted electricity in the operation of their mines, and some of the plants represent the most modern practice in electrical engineering. All classes of generators and transmission lines are to be found, although the earlier types are being discarded.

To show the progress that has been made on the above lines, three colliery plants have been selected for description.

At Bellevue Colliery the winding is done by ordinary steam engines, and in one of the houses is a low-speed engine, driving by belt a 100-KW. 275-volt direct-current dynamo; this was the first machine installed at the mine, and its use is soon to be discontinued. On a lower floor level is a 330-KW. 275-volt direct-current generator, coupled direct to a 500-H.P. engine running at 250 r.p.m. In addition to these two engines and generators, there is a 150-KW. rotary converter, which converts three-phase alternating currents transmitted to this station from the Hampton central power station, some 2 miles distant. Three oil-cooled transformers step down the line voltage from 2,300 volts to 104 volts, for use in the converter. This converter was installed temporarily about a year ago, to help the engines, and will be removed when the new sub-station now in course of construction is completed, when all the power required at the colliery will be supplied from the Hampton central station. In the sub-station will be placed a 300-KW. six-phase rotary converter, which will furnish direct current at 275 volts to the various motors. The six-phase current is obtained from the three-phase line current obtained from the Hampton plant by means of transformers. There are three of these, oil-cooled, 60-cycle and each of 110 KW. capacity. They step down from 2,310 line voltage to 104 volts. The 500-H.P. plant will be transferred to this sub-station, and used to help the converter in case of heavy loads, and to furnish current to the pumps and locomotives in the mine in case it becomes necessary to shut down the central station.

The current is used for lighting the mine and breaker, and operating locomotives, pumps, and for hauling. There are eight locomotives, having an aggregate of 700 H.P. These are of two sizes, weighing 13 tons and 6½ tons respectively. The smaller locomotives carry a cable reel similar to those on the locomotives in the Jermyn Mine, which enables them to travel some distance beyond the end of the trolley wire. There are three hauling machines, which haul the full tubs up inclines which are too steep for the locomotives. The aggregate motor horse-power for hauling is 244. There are also seven motor-driven plunger pumps of the horizontal triplex, quadruplex and quintuplex types, each driven by a single electric motor of suitable size. The aggregate horse-power for this purpose is 248.

In addition to these, there are other motors for miscellaneous purposes aggregating about 30 H.P., and the total horse-power represented by motors at this colliery is about 1,200. The generating capacity of the station is 580 KW., including the rotary converter. Electric signals connect the different shafts with the engine houses, and a telephone system furnishes communication between the different levels and stations in the mine and the engine house.

(To be concluded.)

ELECTRIC TRACTION IN FRANCE.

A YEAR has now elapsed since the opening of the third section of the Paris Metropolitan Railway, and it is of interest to note that while the receipts from the first two lines of this railway during the first eight months of 1904 amounted to close on 13,000,000 fr., with a total number of passengers carried of over 73,000,000, the figures for the same period of 1905, including those of course of line 3, are 16,792,000 fr. and 97,000,000 respectively. It will thus be seen that the increase in receipts and passengers carried is more than proportional to the increase in mileage, the line 3 being only an increase of 5 miles, and the total of lines 1 and 2 being about 15 miles. The present daily average of the three lines of the Metropolitan Railway, opened for traffic, is nearly 300,000 passengers per diem for £2,000 receipts.

In a speech made recently by the President of the Paris City Council, in respect to the Metropolitan Railway of Paris, he referred to the fears that were entertained by the Paris Municipality regarding the facilities which would be afforded to Parisians, by means of the Metropolitan Railway, towards a daily exodus to the suburbs. This is what the authorities have continually in mind whenever traction questions arise in connection with Paris and district, for it is feared that with facilities to gain the suburban regions Paris itself will lose its present fashionable and popular favour as a residential centre, to the detriment of the city revenues. The President of the Municipal Council (M. Desplas), however, stated that this idea had not up to the present time been attended with confirmation, for the Paris Metropolitan Railway has only served to develop the more remote portions of the city, and, in fact, rather helps to retain the population within the city walls than to facilitate its displacement.

If at times some surprise is felt regarding the somewhat slow development of electric traction within and around Paris, the fact that the authorities resolutely set their face against anything tending to diminish the rateable value of the city property will go far to explain the otherwise curious situation.

It can now be stated with certainty that the P.L.M. Railway Co. are preparing estimates in view of the electrification of the Cannes-Vintimille and the Cannes-Grasse divisions of their lines in the South of France. Some time ago 1,000,000 fr. was voted in order to prepare an experimental line and start a 1,600-H.P. locomotive thereon. It has now been decided that the money shall not be expended on experimental work but that work shall be put in hand for the electrification of the two lines above mentioned. It was first intended to equip electrically a line nearer Paris, but it is now believed that the greater publicity to be derived from the transformation of the two southern lines will be such as to make it advisable to commence work on them. It has been estimated that electric power

can be applied to the lines without increase in the operating expenses, and single-phase current would be supplied at comparatively high voltage and transformed on the train into direct-current by the rectifier recently designed by the chief electrical engineer of the P.L.M. Railway Co.

The work will be of importance, as some 20 locomotives, each of 1,600 H.P., will be needed, and some eight or ten motor-car equipments, each of 800 H.P. In the present instance it is believed that foreign material would not be barred from competing.

Although the more important towns in France are provided with tramway systems, the advent of the single-phase motor has opened a field for the development of inter-urban communication, and several District Councils will shortly be looking for parties willing to take up concessions for the construction of systems of this description. The conditions are not very stringent, and the General Councils of the Departments are generally inclined to aid such enterprises with part payment for construction and easy terms as regards interest.

Among other Departments about to take active part in this light railway construction may be mentioned the Department de la Drôme (borrowing 1,550,000 fr.), Manche (13,000,000 fr.), Aisne (over 3,000,000 fr.), Vendée (800,000 fr.).

The Paris General Omnibus Co. has been very slow to recover lost ground occasioned by the competition of the Paris Metropolitan Railway. The receipts for the first 37 weeks (up to September 16th) of this year show on the whole a decrease of 892,630 fr. over the receipts for the same period of 1904 (31,088,865 fr.), but the receipts for the week ending September 16th amount to 756,500 fr., an increase of 2,212 fr. over those for 1904. The rearrangement of traction matters in Paris, shortly to be put in force, is expected to bring some improvement to the affairs of this important company.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

(*Continued from page* 483.)

Fuse and Switch Clips.

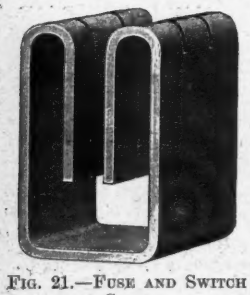


Fig. 21.—Fuse and Switch Clips.

The demand for a full range of sizes in fuse and switch clips is being met by Messrs. A. E. Harris & Co., of 95, Camden Street, Birmingham, who are making these goods from 5-amp. size to 400 amps., of the M type, in brass, copper or bronze. The firm is also well employed in producing special sizes and patterns of clips and contacts to engineers' own specifications, as well as the "thousand and one" small stamped or turned sundries required by the trade.

New Pear Switch.

Messrs. Bonnella Bros., of 40, Rosoman Street, Clerkenwell, E.C. have recently placed on the market a pear switch (Prov. Pat.) of which an illustration is given below (fig. 22). On pushing the spindle in one direction the circuit is closed by a wedge-shape brass block connecting two brass plungers fixed on either side of it to the porcelain base. On pushing the spindle in the opposite direction the circuit is broken by a similarly shaped porcelain block replacing the brass one. As the plungers are fixed on opposit

Fig. 22.

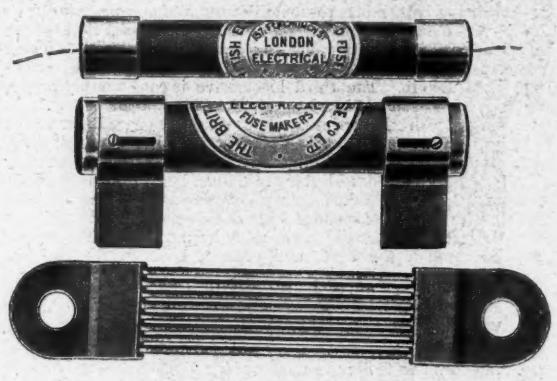
sides of the movable bridge, there is practically no friction between the spindle and its bearings, thus allowing a very free and decided action. The essential parts are made of brass and porcelain, and the "break" being long, it is claimed that there is no risk when using this switch on high voltages. The interior is made quite distinct from the case, so that the latter may be conveniently made of any suitable material or to any design to meet the requirements of contractors. The firm have adapted this movement to several other useful varieties of switches—two-way pear switches, door switches, standard base switches for portable lamps, &c. A small and neat table switch has also been designed suitable for taking the current required by various types of heating apparatus.

Wooden Electric Fittings.

The wooden electric fittings which are now being made by Messrs. J. S. Henry, Ltd., are artistic and unique in design. They are all made by hand, and can be matched with any style of furniture and decorations, without extra expense. They are claimed to be eminently suitable for churches, public halls and libraries, and all buildings which contain an appreciable amount of wood in interior decoration, besides being specially adapted for domestic lighting. An excellent range of designs can be seen at Messrs. Henry's premises in the City, 287-291, Old Street, E.C., or in the West End, 22, St. James's Street, S.W. Those interested in such matters will find a visit to either of the show-rooms well worth while. We understand that Messrs. Henry are prepared to appoint sole agents in districts yet untouched by them. We may add that these wooden fittings may be seen at the Olympia Exhibition, at the stand of the Lancashire Dynamo and Motor Co., Ltd.

Calibrated Fuses.

The British Electric Calibrated Fuse Co., Ltd., of 14, Golden Lane, E.C., are introducing a number of types in open and enclosed fuses for voltages from 50 to 2,000 volts, and several of the special examples we illustrate herewith. Fig. 23 shows their type No. 54 long flexible copper tails, which are made for standard capacities 1 to 50 amperes, give a wide range of centres, and will work equally well connected at the ends of the tails as close up to



Figs. 23, 24 and 25.

the caps. Fig. 24 represents type No. 40 sliding knife clip fuse made to fit all the ordinary clip type distribution boards; it is made for standard capacities from 1 to 30 amperes, and for a ¾-in. range of adjustment between centres. Fig. 25 illustrates the company's type 48 multiple wire link, which they make in either 10, 8, 4, 2 or 1 wire sizes, for standard capacities from 1 to 500 amperes. They are of pyrotin wire with copper lugs, and are claimed to operate within very close limits.

Petrol-Dynamo Sets.

These sets, as supplied by the Societe Gramme, of 144, Gray's Inn Road, W.C., are standardised in four capacities of 1, 2·5, 3·5, and 5·5 KW. They occupy very little space, being compactly arranged on one bedplate, and are designed for running directly on lamps if necessary, without storage battery. A sensitive centrifugal governor and an elastic coupling between engine and dynamo are fitted. The consumption of petrol essence in the smallest type of these sets is under 1½ pints per hour per H.P. produced at the terminals of dynamo, this efficiency being increased in larger sizes. The 5·5 KW. type has a two-cylinder engine.

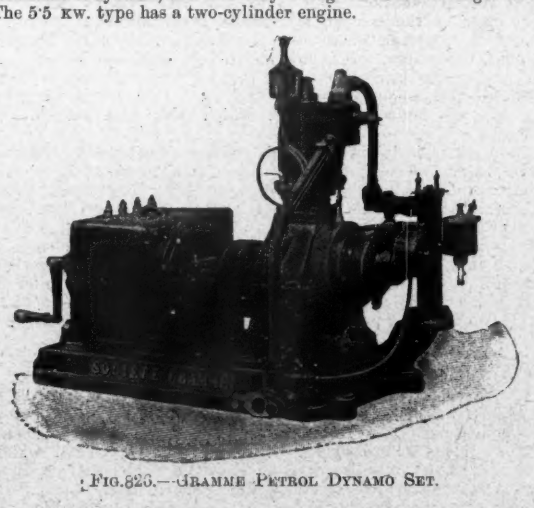


Fig. 26.—Gramme Petrol Dynamo Set.

They are also being supplied direct-coupled with elastic coupling to dynamo on cast-iron bedplate, fitted on strong trolley base, with carburetter, ignition battery, induction coil, auto-lubricator, exhaust silencer, with switchboard completely fitted with ammeter, voltmeter, field regulator, D.P. main switch, cut-outs, &c., switches and connections for charging ignition battery from dynamo; also with a petrol tank, a strong metal-lined wooden water tank to form transport packing case when inverted, and with all tube and cable

connections necessary between engine and water tank and dynamo and switchboard.

These sets are particularly recommended for country house lighting, and more especially in cases where the proprietors are owners of motor-cars, as the petrol engines have all the features of the engines used on automobiles, with the sole difference that they are specially designed in all points for great steadiness in running when coupled direct to dynamos.

New Testing Instruments.

We illustrate below some new patterns of testing instruments which have been placed on the market by Messrs. Moesch and Schmidt, of Basinghall Street, E.C.

Fig. 27 shows a novel and cheap testing set for installation work. It consists of a combined ohmmeter and generator, mounted in a walnut case about 7 in. × 8 in. × 9 in., the whole weighing about 12 lb. Its chief claim for novelty lies in the fact that an absolutely

Fig. 27.—Installation Testing Set.

correct and *positive* reading is automatically obtained by turning the generator handle at an increasing speed until the needle becomes "fixed." Fig. 28 shows the electrical working of this set. The generator I is connected to the moving-coil milliampere meter—reading as an ohmmeter—through the unknown resistance X, and also, in parallel, to the relay R. When the critical voltage is attained at which the ohmmeter reads correctly—*i.e.*, when the precise speed is imparted to the generator, the relay R attracts the arm A, which in turn causes the hoop H to "fix" the reading needle Z. The needle Z then remains at the reading until released by the spring button D.

It will be seen that it is impossible to obtain false readings, owing to voltage variation, since the needle only becomes "fixed" at the precise voltage. These sets are supplied for 110, 220

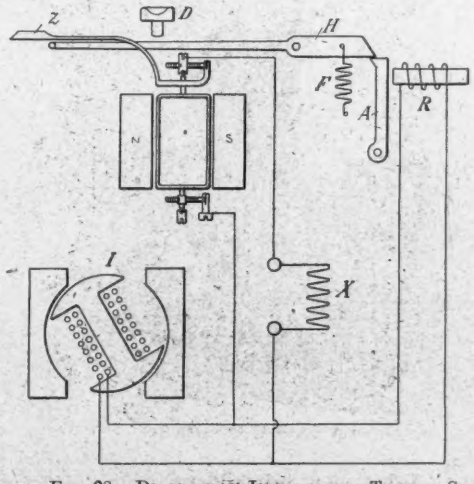


Fig. 28.—Diagram of Installation Testing Set.

and 500 volts, giving readings up to 10, 20 and 50 megohms respectively.

The earth leakage indicator, fig. 29, reads direct in ohms. The top terminal is permanently connected to earth, and the lower terminals to the + and − mains respectively. By means of a small switch arm, readings are taken on either main through the instrument to earth.

Fig. 29.—Earth Leakage Indicator.

The need for an acid-proof portable cell tester has been felt by many who have the care of accumulators. It is claimed for the instrument, fig. 30, that it is absolutely acid proof, is unaffected by

Fig. 30.—Portable Cell Tester.

heat and is practically unbreakable. The voltmeter is of the moving-coil type, and the permanent magnet is contained in the handle.

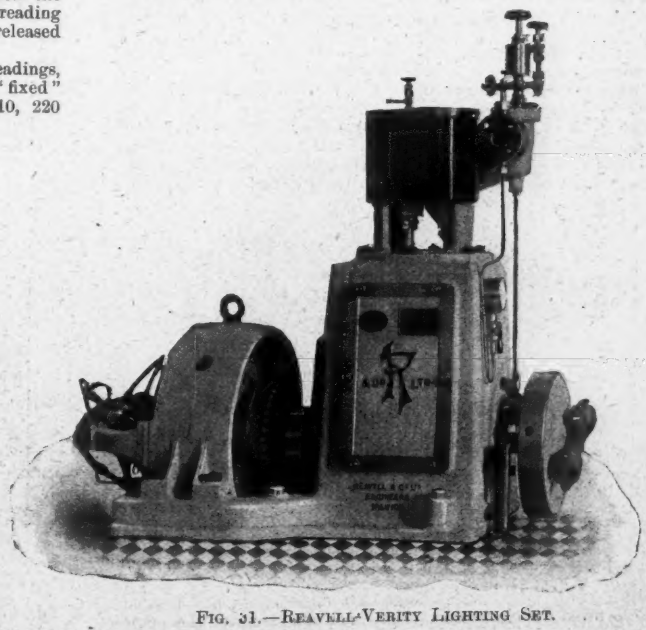


Fig. 31.—Reavell-Verity Lighting Set.

Small Lighting Sets.

Messrs. Reavell & Co., Ltd., of Ipswich, have recently made a special line of small lighting sets to which they fit their double-acting steam engines of high speed enclosed type (fig. 31). During the last

four months some 30 sets have been made; they are specially adapted for meeting the requirements of small installations, and they are in particular demand for ship lighting. Twenty sets with these engines have been supplied to the L.C.C. for its new river steamers, and one is on view at the Olympia Exhibition at the stand of Messrs. Veritys, Ltd.

Stoke Railway Station Lighting and Power Plant.

The accompanying illustration (fig. 32) shows one of two sets of steam engines and generators which have recently been supplied to the North Staffordshire Railway Co by Messrs. Bumsted and Chandler, of Cannock Chase Engine Works, Hednesford, Staffordshire, for lighting Stoke Station, and for running motors in the works close by. These engines are placed under the booking offices, and under the circumstances must, therefore, necessarily be free from vibration and noise. The set illustrated was specified to give 40 kw. with 120 lb. steam pressure, and under test 44 kw. was obtained at 500 r.p.m.

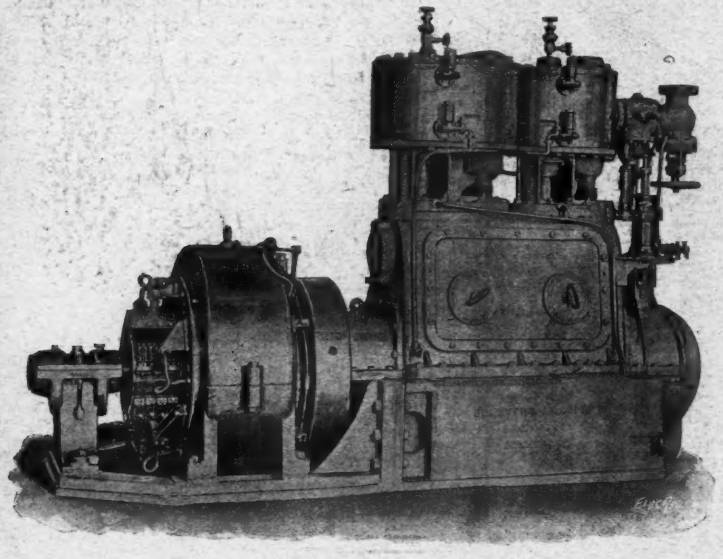


Fig. 32.—Bumsted & Chandler-Royce 40-kw. Plant at Stoke.

The engines are compound, with 13 in. l.p. cylinder and stroke 6 in.; forced lubrication is fitted up to 30 lb. oil pressure when desired, but the pressure can be reduced at will by an adjustable relief valve to 15 lb., which is found ample to keep the engines perfectly quiet.

The oil is forced into all the working parts, bearings, crossheads, pins and guides by a valveless pump, placed at the *end* of the engine in a most convenient position for inspection and cleaning. All the crankshaft bearings are of white metal, and can be taken out, both bottom and top, without moving the crankshaft. The fly-wheel is bolted on to a solid flange forged on the crankshaft. The crank case is fitted with large doors both back and front of the engine, and this, together with the light bonnets over the end bearings and governors, makes every part of the engine easily accessible with ordinary spanners. The makers usually employ metallic packing of their own make, which is durable and steam-tight. The engine base is made with faced flanges at the end, so that any make of dynamo can be fitted to it, thus dispensing with any extra underbase, and, consequently, extra weight and height.

The dynamo was made by Messrs. Royce, of their six-pole type. With a higher steam pressure, the engine is capable of giving 80 b.h.p. continuously. Any water of condensation which may come from the piston-rods is caught in the distance pieces, and then drained away, so that none gets into the crank-pit.

Twin Carbon Arc Lamp.

The twin carbon lamp, which has been devised by Messrs. Smithson, Sharpe & Co., of Manchester, and is illustrated herewith (fig. 33), differs from others on the market in that it consists of two *complete lamps* enclosed in one case and globe. By this means a perfect regulation of the two arcs is obtained, and the two carbons can be made to burn equally. There are two shunt and two series coils in the two distinct lamps; there is, however, plenty of room inside the case, and by careful design each side of the lamp has been reduced to only two working parts. The makers consider that it pays to give good value, in that after the lamp has been bought no trouble is caused through trying to make one set of mechanism do double work, and they state that they have these lamps in use with complete success. They also manufacture a double-carbon lamp of similar outward appearance.

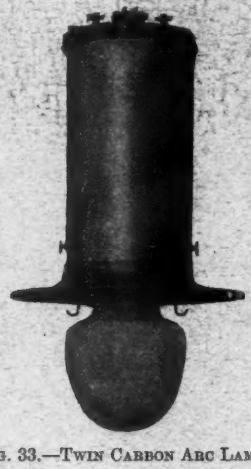


Fig. 33.—Twin Carbon Arc Lamp.

Fig. 34.—"Prehistoric" Design.

Fig. 35.—"Berners" Design.

Ornamental Switch-Plates.

Messrs. Roger Dawson, Ltd., of 8, Berners Street, W., are supplying a variety of high-class switchplates, bell-push plates and other decorative metal work, reproduced from the exclusive designs of Mr. Frank Lutiger, the well-known artist in metals. It is claimed that the artistic feeling is so faithfully portrayed that it is prac-

tically impossible to distinguish these plates from work executed by hand. In the manufacture of the plates great care is taken to ensure an even deposit of copper, and from the specimens which we have selected for illustration, it will be gathered that they are very suitable to form part of a particular scheme of decoration. In regard to finish, they are supplied in oxidised or polished silver, bright or antique copper, and polished or antique brass.

Fig. 34 is No. 1 in the "Prehistoric" series, and fig. 35 represents No. 17 in the "Berners" series of registered designs. Various others appear in the firm's recently issued list, wherein prices and some general information on the subject are also given.

Portable Electric Drills.

In the accompanying figures, Nos. 36 and 37, we illustrate the latest type of portable electric drill which is introduced by Messrs. S.

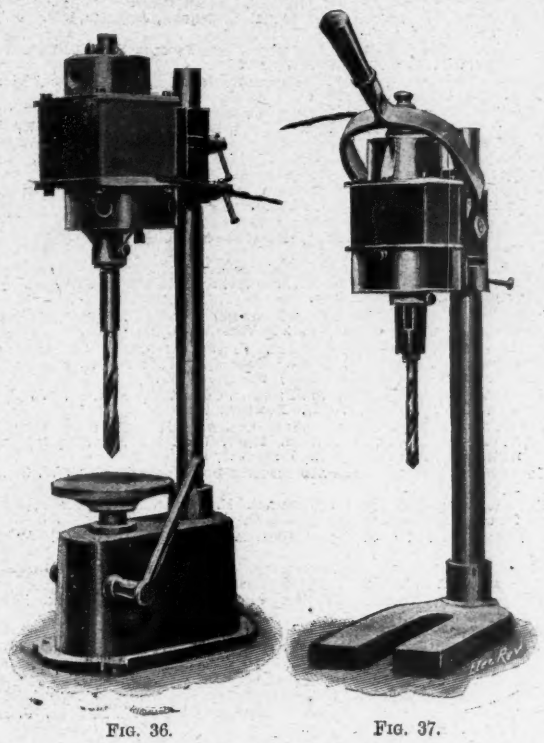


Fig. 36. Fig. 37.

Portable Electric Drills.

Wolf & Co., of 138, Southwark Street, S.E. The motors are geared for a suitable speed, and the views represent two different ways of feeding the drill. The machine is supplied in various sizes for drilling holes up to about 1½ in. in diameter.

The motors are the same as are used with the firm's three-speed electric hand-drilling machines, motor and speed reducing gear being entirely enclosed. The speed reduction and the change of the speed is effected through a sun and planet gearing attachment. The gear wheels are machine cut, and all the spindles run in ball bearings. One of the illustrations shows the feed effected by a lever lowering the machine itself, and the other by a lever raising the object to be drilled with the table. The machines are built in various sizes for drilling, tapping and riming holes up to 1½ in. diameter, and for any voltage up to 500 d.c. The construction is up to date, and first-class workmanship is obtained by a skilled staff, who, we understand, have manufactured electric drills for the last 15 years.

Electric Launch for Sweden.

The photograph which appears below shows an electric launch which has recently been fitted up with the accumulators, gearing, &c., of the Bristol Electric Safety Lamp Works, of Westminster.

The hull, which is built of mahogany, is 18 ft. long, beam 4 ft. 4 in., draught, loaded, 18 in., seating capacity, 10 persons. The motor, which is 1½ h.p., is arranged for 70 volts, and runs at 700 r.p.m. The battery consists of 36 accumulator cells having a storage capacity of 100 ampere-hours, and is sufficient for a 5-hours' run at full speed of about 7 miles per hour.

The dimensions of the accumulators are as follows: 5⅜ × 4⅛ × 9½ high overall. The starting and reversing gear, which is of Mr. Bristol's design, is simple and substantial in construction, and so arranged that the 36 cells can be joined up in two parallels to give 36 volts when required. The starting, as well as half or full speed ahead or astern, is controlled by two levers.

The boat is running on the Norwegian lakes in Setersdal, near Kristianssand, and the power of a waterfall in the neighbourhood is utilised for generating electric current for charging the battery.

(To be continued.)

OUR LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.*]

"R" writes:—"It is desired to install a small generating plant in a workshop, and from it to supply current for lighting purposes, not only to the building itself, but also to seven or eight adjacent shops.

"The neighbourhood is supplied by a local Electric Light and Power Co., this not being a municipal undertaking. I wish to know whether the Supply Co., in virtue of any rights they may possess, can prevent me supplying current within their area either at the price they charge or at a lower rate."

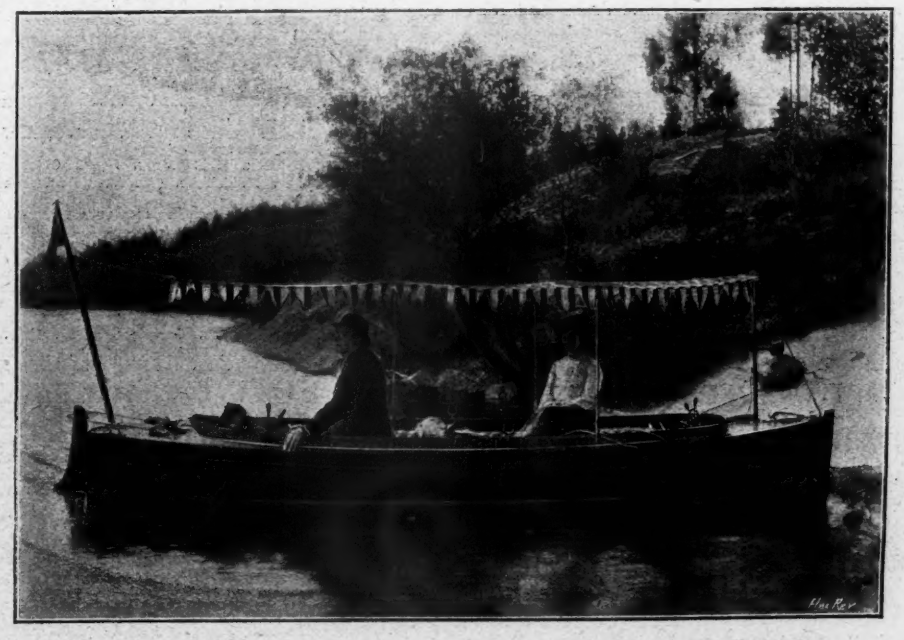


Fig. 38.—Electric Launch for Norwegian Lakes.

*** "R" is quite entitled to install the generating plant and to give a supply to whom and at what price he chooses. The company have no monopoly and no control over him.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

18,209. "Improvements in electric control systems and apparatus therefor." L. A. Tirrill. (Date applied for under Patents Act, 1901, September 8th, 1904, being date of application in United States.) September 8th. (Complete.)

18,264. "Improvements in gas or vapour electric lamps." The firm W. C. Heraeus. (Date applied for under Patents Act, 1901, October 14th, 1904, being date of application in Germany.) September 9th. (Complete.)

18,312. "Improvements in and connected with telephone exchanges working on the central microphone battery system." H. Oppenheimer. (Aktiengesellschaft Mix & Genest, Germany.) September 11th.

18,340. "Improvements in push button and like devices." N. R. Stiles. September 11th. (Complete.)

18,368. "Improvements relating to automatic electrical time switches." J. Berg and F. C. Wilson. September 12th.

18,375. "Improved means for connecting tubular electrical conduits together and to their fittings." J. W. Brooks (trading as the Walsall Hardware Manufacturing Co.) and A. E. Read.

18,380. "An improved cut-off attachment for telephones." E. Wright. September 12th.

18,381. "Reversible galvanic battery." C. B. Askew. September 12th. (Complete.)

18,384. "An improvement in magnetic motors." T. Grainger. September 12th. (Complete.)

18,401. "Continuous-current machine with cord winding and reversing poles." Siemens Bros. & Co., Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) September 12th. (Complete.)

18,403. "Improved incandescence bodies of tantalum wire for electrical glow lamps." Siemens & Halske Aktien-Gesellschaft. (Date applied for under Patents Act, 1901, October 13th, 1904, being date of application in Germany.) September 12th. (Complete.)

18,419. "Telephone improvement and relating to." J. Skwirsky. September 12th.

18,424. "An electric plug adaptor." O. Zimmer. September 12th.

18,427. "Improvements in and relating to apparatus for purification of water by electrical means." J. F. Lester. September 12th. (Complete.)

18,447. "Improvements in electric motor-starting and controlling switches." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) September 12th.

18,459. "Improvements in connection with electricity supply systems." G. Wilkinson. September 13th.

18,484. "Improvements in electrodes and in methods of making same." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) September 13th.

18,485. "Improvements in electric fuses." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) September 13th.

18,519. "Improvements in and relating to electric control systems." The Allgemeine Elektricitats-Ges. (Date applied for under Patents Act, 1901, September 13th, 1904, being date of application in Germany.) September 13th. (Complete.)

18,528. "Improvements in electric heaters." G. Davis. September 14th.

18,620. "Improved slow-speed operating mechanism for electric motor starters and like resistance switches." Veritys, Ltd., and A. E. Gott. September 15th. (Complete.)

18,634. "Improvements in devices for mechanically and electrically connecting tubes or conduits to fittings or other parts." G. Whitehead, Jun. September 15th.

18,646. "An improved ball joint or socket suitable for supporting electric light fittings and for other purposes." H. Hirst and J. H. Collings. September 15th.

18,673. "Bracket for carrying a light on the head and electrical fittings for use therewith." O. Millauro. September 15th. (Complete.)

18,694. "Improvements in and relating to type-printing telegraph transmitters." F. H. W. Higgins. September 15th.

18,697. "Improvements in inspection boxes and fittings for use with steel conduits for electrical purposes." C. E. Gunner. September 15th.

18,750. "A coin-freed magnetic game of skill." W. H. Dingle and J. M. Urquhart. September 16th.

18,751. "Improvements in and connected with electrical resistances." M Chapman and G. L. Stone. September 16th.

PUBLISHED SPECIFICATIONS.

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1904.

Automatic Telegraphic Apparatus. Damaskinos. 21,217. October 3rd.

Electro-Thermic Fans. De Mare. 22,905. October 24th.

Space Telegraphy. Stone. (Date applied for under International Convention, April 11th, 1904.) 29,145. December 30th.

Support for Aerial Conductors Used in Space Telegraphy. Stone. (Date applied for under International Convention, May 3rd, 1904.) 29,146. December 30th.

Telephone System. Brander. 16,068.

Apparatus for the Generation of Electricity, Primarily Designed for the Electric Lighting of Trains. Hutchins. 16,059.

Electrical Winding Mechanism and Switches Connected Therewith. Du Bois. 16,210.

Systems of Electrical Distribution. Weintraub. (Date applied for under International Convention, July 23rd, 1903.) 16,256.

Operating Electric Rectifiers, Vapour Lamps, and the like, in Systems of Electrical Distribution. Weintraub. (Date applied for under International Convention, July 23rd, 1903.) 16,257.

Armature Connection for Motor Electricity Meters. Geyer. 16,815.

Electro-Pneumatic Control Systems. British Thomson-Houston Co., Ltd. (General Electric Co.) 17,018.

Electrical Conductors Specially Applicable to Overhead Conductors for Electrical Tramways. Ginders. 17,862.

Electric Motor-Control and Apparatus Therefor. British Thomson-Houston Co., Ltd. (General Electric Co.) 18,202.

Electrolysers. Bartelt. 18,356.

Single-Phase Commutator Motors. Punga. 19,109.

Electric Arc Lamps. Carolan. (General Electric Co.) 20,380.

Rectifying Alternating Electric Currents. Carolan. (General Electric Co.) 20,381.

Electric Transforming Devices. Carolan. (General Electric Co.) 20,478.

Automatic Electro-Magnetic Controllers, Especially Applicable for Use in Electric Metering Systems. British Thomson-Houston Co., Ltd. (General Electric Co.) 20,548.

Control of Electric Motors. Carolan. (General Electric Co.) 20,550.

Electric Furnaces. British Thomson-Houston Co., Ltd. (General Electric Co.) 20,809.

Electric Furnaces. British Thomson-Houston Co., Ltd. (General Electric Co.) 20,810.

Pipes or Tubes for Containing Underground Electrical Cables or Conductors. Chambers. 20,898.

Construction of Dynamo and Like Brushes. Chaplin and Chaplin. 22,966.

Timing Devices for Turning On and Off Gas, Electric Circuits and Other Agents. Horstmann, Horstmann, Horstmann, Horstmann and Edgar. 27,849.

Electric Igniters for Explosion Motors. Guillou. (Date applied for under International Convention, January 2nd, 1904.) 29,187.

Means for Electrically controlling Phonographs and Cinematographs in Combination. Soc. L. Gaumont & Cie. 15,708. (Date applied for under International Convention, July 17th, 1903.) July 14th.

Alternating Current Electric Meters. Union Elektricitäts-Ges. 15,942. (Date applied for under International Convention, July 18th, 1903.) July 18th.

Trolley Turners or Devices for Moving the Trolley Poles of Electric Cars. J. W. Bamber. 17,748. August 16th.

Electric Controllers. British Thomson-Houston Co., Ltd. (General Electric Co.) 17,809. August 16th.

Processes of Oxidation and Reduction effected in an Electrolytic Bath. O. Imray. (Farbwerke vorm. Meister, Lucius and Brüning.) 18,042. August 19th.

Regulators for Electric Circuits. British Thomson-Houston Co., Ltd. (General Electric Co.) 19,478. September 9th.

Electric Motor Controllers. British Thomson-Houston Co., Ltd. (General Electric Co.) 19,885. September 15th.

Electric Railway Systems employing Sectional Conductors. British Thomson-Houston Co., Ltd. (General Electric Co.) 19,886. September 15th.

Devices for Protecting Electric Railway Signalling Systems from Excessive Current. British Thomson-Houston Co., Ltd. (General Electric Co.) 19,891. September 15th.

Shunts for Electrical Measuring Instruments of the Moving-Coil Type. Evershed & Vignoles, Ltd., and E. B. Vignoles. 19,993. September 16th.

Means for Ascertaining the Power Factors in Alternating Current Systems. A. Grammont. 24,692. (Date applied for under International Convention, November 24th, 1903.) November 14th.

Electric Ignition Apparatus for Internal Combustion Engines. A. Eckstein and H. J. Coates. 26,527. December 6th.

Use of Vapor Electric Conductors in Distributing Systems for Rectifying or other Purposes. O. O. Kruh. 15,469. (Date applied for under International Convention, July 13th, 1903.) July 11th.

Electricity Service Systems and Junction Boxes therefor. G. W. Owen. 16,842. August 2nd.

Electro-Magnetic Brakes for Vehicles. E. Kramer. 16,982. (Date applied for under International Convention, August 7th, 1903.) August 2nd.

Arc Lamps. W. E. Cook. 16,968. (Post-dated September 13th, 1904.) August 3rd.

Means for Receiving or Translating Electric, Wireless or Like Impulses. C. R. Underhill. 16,978. August 3rd.

Electric Bells, Indicators and Domestic Telephones. S. A. Bhisey. 17,049. August 3rd.

Electric Controllers. W. H. Scott. 17,442. August 10th.

Electric Motor Control Systems. British Thomson-Houston Co., Ltd. (General Electric Co.) 18,203. August 22nd.

Transformers especially adapted for use on Electric Vehicles. British Thomson-Houston Co., Ltd. (General Electric Co.) 18,204. August 22nd.

Interrupters for Ignition Coils of Internal Combustion Engines. J. Carpentier. 18,615. August 27th.

Telephone Cord. E. G. Sievert. 19,160. September 5th.

Wall Sockets and Switches for Electric Circuits. G. E. Fletcher. 19,506 September 10th.

Means for Effecting the Ignition of Combustible Gases in Gas Engines. A. H. Thwaite and M. W. Ward. 20,446. September 22nd.

Insulating Edgewise-wound Electric Coils. British Thomson-Houston Co., Ltd. (General Electric Co.) 20,715. September 26th.

Leading-in Conductors for Electric Incandescent Lamps and the Like. E. A. Carolan. (General Electric Co.) 20,965. September 26th.

Electric Traction. R. S. Clouston. 20,976. September 29th.

Electrical Measuring Instruments. G. K. B. Elphinstone and H. F. Fast 21,028. September 30th.

Alternating Current Electric Motors. E. A. Carolan. (General Electric Co.) 21,043. September 30th.

Electric Energy Meter. E. J. Javaux. 21,807. October 4th.

Electric Batteries. H. H. Lake. (Soc. Anon. Le Carbone. 21,672. October 8th.

Means for Trolleys or Vehicles to pick up and return Electric Current from and to Conductors they traverse and obtain motion. R. C. Sayer. 22,372. October 18th.

1905.

Incandescent Electric Lamps. Gerow and Gerow. 1,072.

Induction Regulators for Electric Current. Finzi. (Date applied for under International Convention, January 27th, 1904.) 1,583. March 18th.

Apparatus for Producing Electric Reactions in Gases by Aid of Electric Arcs. Birkeland. (Date applied for under International Convention, February 20th, 1904.) 3,525. February 20th.

Apparatus for Enabling Telephonic and Telegraphic Messages to be Transmitted Over the Same Line. Turchi and Brune. (Date applied for under International Convention, April 2nd, 1904.) 3,913. February 24th.

Vapour Electric Lamps. Thomas. (Date applied for under International Convention, March 28th, 1904.) 5,220. March 18th.

Electric Light Hanger for Walls. Lau. (Date applied for under International Convention, April 23rd, 1904.) 8,253. April 18th.

Electro-Therapeutic Ray Tube. Cossor. 1,369.

Electro-Dynamic Railway Traction Systems. Dulait, Zelenay and Rosenfeld. 1,820.

Pneumatic Devices for Supporting, Actuating, and Controlling the Trolley Poles of Electric Cars and the Like. Gunyon. (Magney Manufacturing Co.) 2,693.

Detectors for Electro-Magnetic Waves or Other Weak Electric Impulses. Thompson. (Ges. für drahtlose Telegraphie m.b.H.) 5,456.

Electric Train Signals. Sullivan and Renshaw. 5,863.

Systems of Electrical Distribution of Direct Currents by Means of Vapour Rectifiers. Hewitt. (Date applied for under International Convention, May 13th, 1904.) 8,972.

Overhead Current Collectors for Electric Railways and Tramways. Platte. (Date applied for under International Convention, May 14th, 1904.) 10,100.

Inter-Communication Telephone Systems. Birnbaum and White. 12,600.